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Asus Zenbook S 14 OLED with Intel Core Ultra 200V

The ambassador is spoiling us with new mobile CPUs right now, with Intel the latest to launch. And the good news is that its Lunar Lake architecture – making its debut in the Intel Core Ultra 200V series of processors – is a hit. That's because its focus on energy efficiency is having such a huge impact on battery life, with this new generation of laptops topping out at around 20 hours. Asus gives the Core Ultra 200V its debut in the super-stylish Zenbook S 14. Has a new era begun?

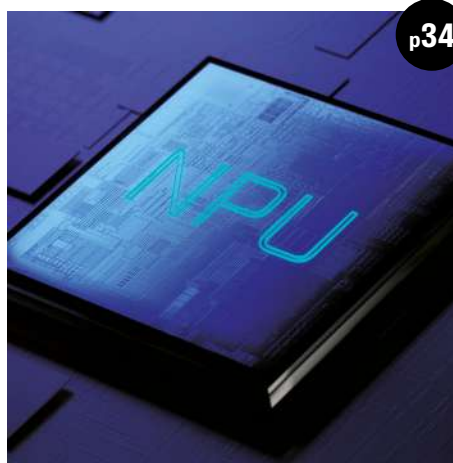


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We say, delegate the dull jobs so that you can do more interesting stuff instead.



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Andrew Byatt

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p46 **FIRST REVIEW INTEL'S BEST-EVER LAPTOP CHIP**

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Every new Pixel phone
Tested. Rated. Recommended?



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AI will let you work asynchronous hours – and maybe fewer days, predicts Nicole Kobie. At least that sounds like a nicer future than robots taking our jobs.

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You can't slow the march of time – or of AI

Ever since I turned 18 I've had the sense that some God-like figure has been slowly pressing their foot upon the accelerator of my life to make time spin faster. In my head, I figure I'm 31, maybe 32 at a push, and even if I'm willing to concede that there's a "5" at the beginning of my age I absolutely refuse to agree to it being autumn 2024 already. I'm pretty sure it should be April.

When an Italian reporter told me "it's going too fast" during an event at IFA 2024 (see p42) I naturally assumed he was thinking the same thing. But then he added: "No-one is in control and it needs to slow down." Turns out he wasn't talking about our lives flashing past, but the AI industry. An industry with no single person at the helm, merely a mush of companies all attempting to nudge ahead of one another. That could be Nvidia, Lenovo, Intel, Midjourney, AMD, OpenAI, Microsoft – everyone has their elbows out and damn the consequences.

But like a badly run government, the end result is confusion and

distrust among the masses. Some people openly fear AI, and I understand that position. Others embrace it with open arms, and good for them. Many are sceptical about the hype, and they have a point. But I think the absolutely right path right now – especially for so-called techies – is to understand AI, play with the tools so you know what they can and can't do, and embrace them where they might just help you out.

That's why when I first started thinking about this month's magazine cover I thought it should have "AI SPECIAL" emblazoned at the top. I wanted to get across the idea that we've tried to cover all those bases this month. Darien has written an excellent guide to NPUs on p34. Barry has interviewed several people who are using AI to help them in their jobs on p26. I review Intel's new family of "Lunar Lake" CPUs on p46, along with a lovely Asus laptop giving Lunar Lake its debut, which serves as an important landmark for local AI.

Turn to p72 and you can read Nigel Powell's verdict on five cloud-based

AI services that help you create art, films and music. As Nigel points out, services such as Midjourney and Leonardo now seem like veterans in the AI art world. They are, after all, almost two years old. Every month a new service appears to great fanfare, and most disappear from view again soon after.

I'm not saying this is good or bad. It just is. Trying to appoint a global super-regulator to slow down the march of AI would be as fruitless as me attempting to tell everyone I'm still in my early 30s and looking forward to the new album from the up-and-coming Spice Girls. Whether we like it or not, we can't tell the industry what to do. It will continue to scattergun us with new products, services, ideas and skills, and ultimately we – the paying public – will decide what we want to use and what to ignore.

And, aside from staying forever young, isn't that what we all really, really want?

Tim Danton
Editor-in-chief

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Stuart Andrews

If you want a smart speaker then Stuart's your man. He puts 14 to the test for cleverness, audio quality and features, including five smart screens, in our Labs test starting on p78.



Steve Cassidy

If your business' Wi-Fi is annoying your team it may be time to upgrade to a newer standard. Find out if that's the right decision by taking every key factor into account, as Steve explains from p104.



Nik Rawlinson

Fancy a break from AI? Nik explains how to master Clipchamp, Microsoft's surprisingly capable video editor that's built into Windows 11 and free to download for Windows 10 users. See p38.



Rois Ni Thuama

And if you haven't had enough of AI, Rois explains why she's so in love with the EU's AI act, which should put an end to the "scoundrels, charlatans and fraudsters". All becomes clear on p116.

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What technology, or aspect of technology, did you think would arrive by now that hasn't?

"I remember visiting Lernout & Hauspie's ear-shaped HQ in the early 2000s and confidently predicting that keyboards would soon be a thing of the past, such was the power of voice recognition. Thank goodness I was wrong, as what else could Barry offer as Hot Hardware on the PC Pro podcast?"

"Online access to all the world's libraries. Google offered to digitise them all, at a time when it had the funds to do it, unlike most governments. The idea foundered due to publishers protecting their IP rights, and over suspicion that Google's motives might become less altruistic and more mercenary in future."

"3D printing. By now we should be combining plastic and metal materials to assemble working electronic devices on our desktops!"

"Something that would take full advantage of the gigabit connection I've had for more than a year now. I feel like I bought a Porsche that can only drive in 20mph zones. Or Guernsey, as the locals call it."

"I really thought fully automated smart homes would be more of a thing, but it's too expensive and just bits and pieces."

"An effective spam deterrent. Bill Gates reckoned we'd have had it by 2006, but I'm still waiting. That or X-ray specs."

"More widespread use of gene therapy, nanomachines and Blade Runner-style replicants."

"Better recycling technology. The majority of the infrastructure is antiquated so we still incinerate most of our waste like our neolithic ancestors who burnt dung to keep warm."

"I want a car as an appliance. Something I get into and tell it to take me home, whether I am sober or mildly tiddy. Tesla has promised this for years and still fails to deliver in the UK, despite them taking thousands for 'Full Self Driving' upgrades."

"Functioning hoverboards, saucer-shaped light aircraft, time travelling Deloreans, reasonably priced space travel, hologram telephone calls. And I've been waiting since primary school."

"Affordable interactive holographic displays to replace desktop and laptop monitors. And robot sex slaves, of course."

"Truly immersive VR gaming. Sure, we have PC headsets, the Quest 3, Apple Vision and PSVR2, but I still think the graphical fidelity isn't there to compete with flat-screen console gaming, and there are too many cludges, annoyances and irritations that pull you out of the experience."

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Briefing

Background and analysis on all the important news stories

Broadband battlelines drawn ahead of Ofcom review

Openreach urges regulator to blow open Virgin Media O2's network



The CEO of Openreach has urged Ofcom to give rivals open access to Virgin Media O2's network, ahead of a major telecoms review.

The regulator is currently in the process of conducting a Telecoms Access Review that will lay down the rules for telecoms and broadband firms for the five years after April 2026. Openreach is using that opportunity to pressurise the regulator into forcing Virgin Media O2 to give rivals access to its ducts, potentially increasing competition in many areas of the country and avoiding the need to install ugly telegraph poles in some communities.

Under the current rules, Openreach is forced to offer access to its nationwide network of poles and ducts under a scheme called Physical Infrastructure Access (PIA), which is regulated by Ofcom. This means prices for access to the poles and



“Openreach is pressurising Ofcom into forcing Virgin Media O2 to give rivals access to its ducts”

ABOVE Openreach has to offer rivals access to its network of poles and ducts

ducts are capped by Ofcom and that Openreach must offer rivals the same access as it offers to BT/EE, part of the same group.

Openreach CEO Clive Selley argues it's now time the same rules were applied to Virgin Media O2 and other fibre providers, such as CityFibre. “Ofcom and government should also require Virgin Media O2 (VMO2) and others to open up their duct and pole networks on the same transparent terms including price as Openreach's duct and poles product,” he said in a statement.

Virgin Media O2 has already announced plans to create the equivalent of Openreach, an as yet unnamed company that will allow broadband providers such as, say, Zen Internet to buy wholesale access to its fibre network. Not surprisingly, the company is firmly opposed to Selley's suggestion it should also be forced to open its ducts at regulated

prices, allowing others to install their own fibre in Virgin's infrastructure.

"The ability to use Virgin Media's ducts on a commercial basis already exists, but Openreach has significant market power in the UK and a footprint that covers almost all of the country, so it is right that it remains appropriately regulated to ensure it cannot use its monopolistic muscle to constrain emerging competition," the company said in a statement.

"Virgin Media O2 and others are building fibre to increase network choice in the UK and it's important that Ofcom supports these investments so that truly scaled competition can be realised in future. Calling for regulatory intervention on others who are building alternative networks is a worrying and diversionary tactic that Openreach has used before with no success."

Openreach moves in

Broadband experts believe Openreach's call for regulated access to Virgin's network isn't merely point scoring, but a ploy that could actually extend Openreach's own footprint. "There are areas where Openreach, for many historical reasons, doesn't have a duct network, and may even not actually have poles," said Andrew Ferguson, editor-in-chief of ThinkBroadband.com.

Instead, those areas are served by copper cables buried directly in the ground, which aren't capable of delivering the gigabit speeds demanded by today's broadband customers. "So having access to that [Virgin Media O2 infrastructure] will help Openreach, if it's on reasonable terms," he said.

Ferguson adds that smaller fibre providers – so-called altnets – "could also get a boost" from regulated access to Virgin's ducts, as it would allow them to roll out in areas not covered by Openreach's PIA infrastructure, or areas where they've previously agreed not to install poles, which are often unpopular with local residents.

However, Ferguson believes there's only a slim chance that Ofcom will be won over by Openreach's pleas to regulate Virgin's duct access, saying there's a mere 15% likelihood that the regulator will be swayed.

What's more, Ofcom "is not going to rule on this for another year or



more," said Ferguson. "Even if today they said yes, Virgin Media have to do a PIA product that's the equivalent of what Openreach offer, it's still going to take perhaps two years for the first actual premises to be connected using it."

Broadband switch headache continues

Meanwhile, an Ofcom scheme that is designed to make it easier for broadband customers to switch providers has again been plagued by delays and problems.

The so-called One Touch Switch system is intended to make it as simple to switch to providers on different wholesale networks (say BT Broadband to Virgin) as it is between Openreach providers (say BT Broadband and Zen Internet). It reduces the time it takes to switch to as little as a day, compared to the week or more it can take currently.

The system was initially meant to go live in April 2023, but has been beset with technical problems, which saw the deadline pushed back to mid-September of this year. However, with less than a fortnight to go before that extended deadline, Ofcom announced that the old switching system would still be in place for another six weeks to handle customers who were failing to be transferred using the One Touch process.

In a letter sent to broadband providers, Ofcom insisted that the old system only be used "as a back-up option, and only in those circumstances where communications providers, having started the switching process via OTS, find that it is not possible to technically proceed".

In a forum update for its customers issued in late August, broadband provider Andrews & Arnold reported that it was able to use One Touch Switch for a range of providers, including Virgin Media and Hyperoptic. However, it added that "things are not working correctly to all CPs [communications providers] in the trial. We are not allowed to tell you which, or what, so you will have to guess. Sorry."

LEFT Openreach CEO Clive Selley wants Virgin Media O2 to open up its infrastructure to rival companies

Wireless that beams through thick walls

New 6GHz wireless bridge lights up old offices

A new wireless product called WaveCore is promising to make networking easier in premises with thick concrete walls.

WaveCore is designed to be rolled out in buildings where solid walls make Wi-Fi unreliable, forcing the building's owner to either drill through the wall or send cabling on circuitous routes around the building. In older premises, drilling through walls to insert cables can sometimes require expensive survey work or permits.

US company Airvine claims WaveCore eliminates this problem by passing a multi-gigabit wireless signal through walls up to 12in thick. It does this using a pair of devices fitted either side of the wall, which effectively act as a bridge.

The WaveCore units operate in the same 6GHz band as Wi-Fi 7, but the firm claims it has enough spectrum to ensure the signal penetrates brick or concrete. "The 6GHz band offers between 500MHz and a full 1GHz of spectrum to operate in, depending on regulatory domain," Dave Sumi, vice-president of marketing at Airvine Scientific told *PC Pro*.

"We chose this band for the available spectrum. With our design we are able to achieve substantial link margin, thus enabling penetration of barriers such as concrete."

In the UK, Ofcom is still yet to decide what to do with the upper portion of the 6GHz band, but Sumi claims this won't be a problem. "The product is designed to operate in a wide variety of countries," he said. "It can be configured to meet UK, EU and many other requirements that have different power levels, spectrum ranges and more. We absolutely will be certifying it for use in the UK."

The company claimed its goal when designing the WaveCore was to exceed 2Gbits/sec through a minimum of 12in of concrete, but in proof-of-concept deployments it was able to hit speeds just under 4Gbits/sec.

The WaveCore can be powered via a PoE source such as a switch or with a 12V DC power supply that plugs into the wall. A pair of units will cost around \$2,500.



Altnets could also get a boost from regulated access to Virgin's ducts

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Is too much caught on camera?

Could your car be confiscated for witnessing a murder? **Barry Collins** investigates the odd consequences of video capture everywhere

If you come back to a parking spot to find your car's been towed away, you've had a bad day. If you come back to find your car's been towed because it potentially witnessed a murder, you've had a really bad day.

This is reportedly what's happening in the US, where according to the *San Francisco Chronicle*, police are obtaining warrants to tow away Teslas that have been parked near crime scenes, in case their cameras have captured evidence of the crime.

It's an extreme example of a growing trend, where footage captured on consumer devices is being used to assist police investigations. Whether it's a video doorbell capturing a neighbour's car being stolen, dashcam footage showing a traffic accident or passers-by recording an incident on their phone, police are increasingly turning to citizen-captured evidence.

For decades, the tabloids have been obsessed with "Big Brother Britain" and the number of state CCTV cameras capturing our movements. But with video doorbells fitted to a fifth of all homes, according to 2022 figures from Consumer Intelligence, and the wide variety of other video capture devices out there, privacy campaigners fear we are now truly living in a

"surveillance state". And that's before we even consider related technology, such as AI facial recognition.

Is there anything consumers can do to prevent their devices being dragged into criminal investigations? And do we have to accept that our every move in public is likely now captured on video somewhere?

■ Chief witness

Having your car towed away because it potentially witnessed a crime might sound like one of those "silly season" news stories where a threat is overblown, but legal experts believe that the use of such evidence is only likely to increase.

"Due to the flood of new data being generated by devices, I do expect law enforcement demands for digital evidence in criminal investigations, including from outward-facing cameras on cars and home video doorbells, will increase," said Linda V Priebe, a partner with US legal firm Practus, LLP, and a cybersecurity specialist.

This is one of those areas where the law hasn't kept pace with the technology. The US, for example, has no nationwide data privacy law, and there's not much individual citizens can do if the police decide that their devices may have witnessed a crime. Even though the Fourth Amendment may require law enforcement to obtain a warrant to capture the video evidence, most

American judges will grant such warrants if there's other evidence a serious crime has been committed.

Until recently, US police forces didn't even need a warrant to obtain evidence from video doorbells. Amazon's Ring allowed police to request video footage of suspected crimes captured on customers' doorbells,

through a system called Request for Assistance, part of the Ring Neighbors app, which could be considered the modern-day equivalent of Neighbourhood Watch.

Initially, Ring would email customers on behalf of police forces if they requested footage. Then, in 2021, it only allowed police forces and fire departments

Does the face fit?

Facial recognition – whether running in real-time via CCTV at big events or on pre-recorded footage – is now commonly used by UK police forces. But the legal grounds for its use are much disputed.

The Home Office website unequivocally states that "there is a comprehensive legal framework in the UK, which means that the police can only use it [facial recognition] for a policing purpose, where necessary, proportionate, and fair".

However, a Justice and Home Affairs Committee hearing held last December exposed that there are no specific laws detailing the use of facial recognition. When challenged by the former director of Liberty, Baroness Chakrabarti, on the legality of using facial recognition to identify criminal suspects, Lindsey Chiswick, director of intelligence at the Metropolitan Police, admitted that there was no specific legislative authority for the deployment of AI, claiming that a case brought against South Wales Police "found that

common law was sufficient to be able to deploy that technology".

Chakrabarti argued that there was, in fact, a "patchwork of totally differential criteria that are being adopted around the country by different police forces".

The EU's AI Act (*see p116*) will effectively outlaw the use of the facial recognition except when authorised by a high-ranking member of the judiciary for specific serious crimes. That led Professor Karen Yeung, a fellow in law, ethics and information from the University of Birmingham, to conclude that our use of facial recognition was comparable to that of China, making the UK "an outlier as a democratic state in the pace at which we are embracing these technologies".





ABOVE If your car witnesses a crime, it could be brought in for questioning

to post public messages requesting footage in the Neighbors apps, following accusations that the police were unfairly targeting people of colour. In January this year, Amazon suddenly announced it was “sunsetting” the Request for Assistance tool, without any real explanation. “Public safety agencies like fire and police departments can still use the Neighbors app to share helpful safety tips, updates, and community events,” Amazon stated in a blog. “They will no longer be able to use the RFA tool to request and receive video in the app.”

■ Police requests

But just because Amazon has frozen its formal procedure for requesting footage, it doesn’t mean that police are no longer pursuing such evidence. Far from it. Here in the UK, some police forces are actively encouraging homeowners and businesses to register their cameras, in case a crime is committed in their area.

For example, North Yorkshire Police allows both homeowners and businesses to register their video doorbells or security cameras with the force’s NICE Investigate Community Portal. “Security cameras can deter criminals in the first place – and also help us identify them and bring them to justice,” the force’s website claims.

Users can register the precise location of their cameras as part of the registration process. “This is especially beneficial to the police force when any of your external-facing cameras are registered as they may assist the police in tracking down suspects, missing people etc outside your premises,” the registration form reads.

Yet, while many people might be happy to submit video evidence to the police, particularly if it concerns crimes that affect them or their neighbours, civil liberties groups are worried about the increasing level of surveillance from devices that aren’t ostensibly designed to capture crime.

“These devices are contributing to a surveillance state where we can be recorded in our own street without permission,” said Pam Cowburn, head of communications and campaigns at the Open Rights Group (ORG). “Although all CCTV owners should ensure they are not recording more than necessary, this is harder to ascertain when individuals use cameras. The police may find the proliferation of these devices useful for their

investigations but it’s not proven that they help to prevent crime, and they can instead engender fear and suspicion within our communities.”

The ORG believes the legal framework governing law enforcement access to consumer cameras needs to be much tighter, particularly when law enforcement is bypassing device owners and going straight to the tech companies storing the footage, as the US police were doing with Amazon. “There need to be stronger safeguards to regulate requests made by law enforcement agencies to private companies,” said Cowburn.

“Currently, legal demands can

be made, but also companies can choose to hand footage over voluntarily. Customers of these devices also need to be made aware if the data they are collecting can be accessed by law enforcement agencies. While some people may instinctively want to help fight crime, they may not be comfortable with the police accessing footage of, for example, a protest.”

The ORG recently highlighted an example of how such a loose framework might be abused. It cited the example of a Home Office scheme to supply CCTV equipment to places of worship such as mosques and synagogues, to help deter attacks. However, the equipment used was provided by a single provider, a US firm that’s privacy policy acknowledges the possibility that its data could be seized under the Foreign Intelligence Surveillance Act, which “permits the [US] government to conduct targeted surveillance of foreign persons located outside the United States”.

With the UK and US engaged in various intelligence-sharing initiatives, that means “government schemes to provide mosques with CCTV equipment could lead to the mass surveillance of people in a place of worship,” according to Cowburn.

“These devices are contributing to a surveillance state where we can be recorded in our own street without permission”

■ Cameras everywhere

It’s not only cameras fixed to the outside of properties that are capable of capturing crime, of course. As well as the video

cameras each of us carry in our pockets in our phones, we’re heading towards an era where always-on personal video cameras could become a very real possibility.

Although devices such as Apple’s Vision Pro are rare and currently designed to be used in the home, augmented reality headsets are widely expected to be worn everywhere and much more widely used in the coming years. “Augmented reality headsets will grow from a smaller base of less than a million units in 2024 to 10.9 million in 2028,” analyst IDC predicts.

When we’re all walking down the street with cameras built into our glasses, don’t be surprised if you’re tapped on a shoulder by a police officer, asking to review what you’ve just seen...

The A-List



The best products on the market, as picked by our editors

PREMIUM LAPTOPS

NEW ENTRY

Asus Zenbook S 14 OLED

Staggering battery life for £1,750

from scan.co.uk

Asus gives Intel's "Lunar Lake" family a debut, pairing a Core Ultra 9 288V with a 72Wh battery to produce a laptop that lasts almost 20 hours on a charge. What's more, this 1.2kg machine looks (and feels) the business.

REVIEW Issue 362, p46



BUSINESS LAPTOPS

Lenovo ThinkPad T14s Gen 6 (Snapdragon)

Copilot+ PC for £1,500 exc VAT

from lenovo.com

It's perhaps a controversial choice – and we wouldn't roll this out en masse – but if you're buying for executives or CTOs this cutting-edge Copilot+ PC, complete with a Qualcomm Snapdragon Arm processor, is a superb choice. Not only is it good value, it's light, it's fast and its all-day battery life is genuinely 24 hours.

REVIEW Issue 360, p56



Apple Mac Book Air 13in (M3)

Both the 13in and 15in MacBook Airs impress for speed, styling and battery life, but the 1.2kg 13in Air wins out of the two for its sheer portability. **From £1,299**

from apple.com

REVIEW Issue 356, p54

Apple MacBook Pro 16in (2023)

The M3 chips give the MacBook Pro series a boost in games with no sacrifices elsewhere, so you just have to grapple with the big decision: which M3 chip? **From £1,699**

from apple.com

REVIEW Issue 352, p46

Asus ProArt PX13

With AMD's new Ryzen AI 9 HX 370 inside, this 1.4kg compact powerhouse offers incredible amounts of power. Add a fantastic OLED screen and RTX 4070 graphics and it's a winner.

From £2,000

from uk.store.asus.com

REVIEW Issue 361, p50

Lenovo ThinkPad X1 Carbon Gen 12

The X1 Carbon range has stepped up a gear thanks to Intel's Core Ultra chips, and Lenovo matches it with the stunning build quality and keyboard you'd expect. **From £1,375**

from lenovo.com

REVIEW Issue 358, p58

Dell Latitude 9450 2-in-1

This 14in convertible, based around Core Ultra CPUs, lacks for nothing, whether that's speed, battery life (around 16 hours), build quality or flexibility. **From £1,560**

exc VAT from dell.co.uk

REVIEW Issue 361, p63

HP Dragonfly G4

It's not the fastest machine you can buy, but otherwise this 1kg masterpiece is as close as you're going to get to the perfect business laptop for executives.

From £1,380

exc VAT from hp.com

REVIEW Issue 352, p58

COPILOT+ PCs

Lenovo Yoga Slim 7x (Gen 9)

AI on demand, £1,350

from lenovo.com

You won't find a better-value laptop, never mind one that meets the Copilot+ PC criteria. With a Snapdragon X1E-78-100 inside it isn't the fastest in benchmarks, but it's incredibly nippy in practice, the battery lasts over 16 hours and the 14.5in OLED screen is top quality.

REVIEW Issue 361, p57



EVERYDAY LAPTOPS

Acer Aspire 14 A14-51GM

Compact power for £850

from acer.com

Want gaming power? Buy the version with RTX 2050 graphics for £850 (part code NX.KSVEK.005). Just care about value? Get a Core 5 processor and integrated graphics for £600 (part code NX.KRWEK.00B). Whichever you choose, it's a staggering laptop for the price.

REVIEW Issue 359, p82



Samsung Galaxy Book4 Edge

A classy 16in laptop that weighs 1.6kg, uses the fastest Snapdragon Elite X chip and delivers a solid 12 hours of battery life.

512GB, £1,499

from samsung.com

REVIEW Issue 360, p53

Microsoft Surface Laptop, 7th Edition

The poster child for Copilot+ PCs offers quality, great looks and staggering battery life.

From £1,049

from microsoft.com

REVIEW Issue 360, p50

Asus Zenbook S 15 OLED

With a price drop to £1,200 this 15.6in laptop becomes a viable competitor to the Yoga Slim 7x if you need a bigger screen. **£1,200**

from uk.store.asus.com

REVIEW Issue 359, p52

Asus Zenbook 14 OLED (UX3405)

If you can stretch past £1,000, this is a top-quality Core Ultra laptop with a superb 120Hz screen and great battery life. **From £1,099**

from uk.store.asus.com

REVIEW Issue 359, p58

Framework Laptop 13 (DIY Edition)

With a competitive price, modular approach and easy-to-repair ethos, you can pick and mix your perfect 13in laptop. **From £779**

from frame.work

REVIEW Issue 360, p58

Huawei MateBook D16

It's big and certainly not bashful, packing an Intel Core i9 chip and a high-quality 16in panel – and surprisingly good battery life, too. **£1,000**

from huawei.com

REVIEW Issue 359, p87

CHROMEBOOKS

Acer Chromebook Spin 714

Flipping great for £799

from [currys.co.uk](https://www.currys.co.uk)

Simply the best Chromebook around. Others may beat the 12th gen Intel Core i5 we tested for performance, but for features, design and bang for buck you won't find any laptop that can match this convertible for £799.

REVIEW Issue 356, p83



Acer Chromebook Plus 515

This Chromebook Plus laptop is all about value. With strong speeds thanks to Intel's Core i5-1235U processor, and a good-quality 15.6in panel with a 1,920 x 1,080 resolution, Asus' Chromebook Plus 515 is ideal for families, students and business users, providing mobility isn't your main priority as it isn't particularly light at 1.7kg.

£429 from [currys.co.uk](https://www.currys.co.uk)
REVIEW Issue 356, p82

Lenovo IdeaPad 5i Gaming Chromebook Plus

The 120Hz 15.6in display is the star of this Chromebook, as it should be with 2,560 x 1,600 pixels to play with. You're getting a lot of laptop for the price, too, including a 512GB SSD, Core i5-1235U processor and 8GB of RAM. Just note the 1.9kg weight.

£659 from [very.co.uk](https://www.very.co.uk)
REVIEW Issue 356, p88

MINI PCs

Apple Mac mini (2023)

M2 masterpiece from £649

from [apple.com](https://www.apple.com)

The outside remains the same, but this simple yet effective update to the Mac mini introduces the M2 and M2 Pro processors with predictable effect. The entry-level price quickly rises once you start upgrading – moving from 8GB to 16GB costs £200, as does doubling the base storage from 256GB to 512GB – but there's enough power here to last you for years.

REVIEW Issue 343, p60



Geekom A8 Mini PC

Geekom makes brilliant use of AMD's Ryzen 9 8945HS in this powerful mini PC, which occupies little more desktop space than a drinks coaster. And it still packs every port most people need, plus Wi-Fi 6E. If you don't need this much power (or 32GB of RAM and a 2TB SSD) the Ryzen 7 version is £719.

Ryzen 9, £899 from [geekom.co.uk](https://www.geekom.co.uk)
REVIEW Issue 359, p62

MSI Cubi NUC 1M

One of the most versatile mini computers we've seen and available in barebones or fully configured, the power-efficient Cubi is based around Intel's latest Core processors. With Thunderbolt 4, lots of storage options and two 2.5GbE connections, there's very little it can't do.

Barebones, from £349 from [scan.co.uk](https://www.scan.co.uk)
REVIEW Issue 361, p64

ENTHUSIAST PCs

CyberPowerPC Ultra R77 RTX Gaming PC

RTX Super 4080 power for £2,275

from [tinyurl.com/356cyber](https://www.tinyurl.com/356cyber)

The striking case catches the eye, but it's the potency of AMD's Ryzen 7 7800X3D and Nvidia's RTX 4080 Super graphics that leave the lasting effect.

REVIEW Issue 356, p62



CyberPowerPC Infinity X145 Elite

Designed to deliver the maximum possible gaming power for £999, this Core i5-14400F system – with 32GB of DDR5 RAM and GeForce RTX 4060 graphics – is a great machine now with potential for more later.

£999 from [tinyurl.com/360cyber](https://www.tinyurl.com/360cyber)
REVIEW Issue 360, p61

Palicomp AMD Destiny

An incredibly fast gaming PC for the money thanks to the wicked combination of AMD's Ryzen 7 7800X3D and Nvidia's GeForce RTX 4070 Super. With a fast 1TB SSD and 32GB of RAM in support, it's enough for smooth 4K gaming.

£1,249 from [palicomp.co.uk/d destiny-mag1](https://www.palicomp.co.uk/d destiny-mag1)
REVIEW Issue 360, p60

ALL-IN-ONE PCs

HP Envy 34 All-in-One

£2,099 widescreen wonder

from [hp.com](https://www.hp.com)

Built around a high-quality 34in widescreen – which is perfect for viewing two windows side by side thanks to its 21:9 aspect ratio – this also comes with Nvidia RTX 3060 graphics. We're big fans of the magnetic 16-megapixel camera, too.

REVIEW Issue 335, p46



Dell Inspiron 24 All-in-One

Despite being built to hit a price point, the Inspiron 24 All-in-One manages to look classy, include a good-quality, 1,920 x 1,080 24in panel and have enough power to breeze through a typical day's tasks. It even packs mod cons such as a 720p webcam. Superb value for money.

From £599 from [dell.co.uk](https://www.dell.co.uk)
REVIEW Issue 350, p47

Apple iMac 24in (M3)

The iconic design remains the same, but the plain M3 chip inside the revamped iMac 24in is a revelation compared to the previous M1 version. The downside is that the base configuration includes a stingy 8GB of memory and a 256GB SSD.

From £1,399 from [apple.com](https://www.apple.com)
REVIEW Issue 352, p52

CREATIVE WORKSTATIONS

Armari Magnetar M64T7-AW1650G4

Threadripping power for £8,329 exc VAT

from [armari.com](https://www.armari.com)

AMD's Ryzen Threadripper 7980X is the star of this particular show, dominating our benchmarks with the help of 128GB of RAM, two 2TB Crucial PCI-E 5 drives in RAID0 configuration and AMD's Radeon Pro W7800 professional GPU. And it's all wrapped up in a custom Armari case with liquid cooling.

REVIEW Issue 361, p92



PCSpecialist Quantum Goliath R

Extracting maximum power from its budget by opting for consumer components with professional levels of power, this well-thought-out workstation couples Intel's Core i9-14900KS with RTX 4090 graphics to tremendous effect.

£3,750 exc VAT from [pcspecialist.co.uk/reviews](https://www.pcspecialist.co.uk/reviews)
REVIEW Issue 361, p89

Scan 3XS GWP A1-TR64

A more balanced offering than Armari's Magnetar, Scan mixes a Threadripper 7970X with Nvidia RTX 5000 graphics – and a stunning supporting cast of components with an equally stunning case. Perfect for real-time viewsets and GPU accelerated computation.

£7,917 exc VAT from [scan.co.uk](https://www.scan.co.uk)
REVIEW Issue 361, p94



TABLETS

Apple iPad Air (M2)

M2 power from £599
from apple.com

We love the new iPad Pro, but for most people the M2 iPad Air is not only far better value but also all the tablet they'll need. It supports the Magic Keyboard and Pencil Pro, plus it's now available in both 11in and 13in sizes.

REVIEW Issue 358, p50



Apple iPad Pro (M4)

The best tablet in the world becomes even better thanks to Apple's stunning M4 chip, a gorgeous OLED screen and the must-have accessory: the all-new Pencil Pro. But it comes with an obvious downside of cost, with the cheapest 13in incarnation costing £1,299. **From £999 (11in, 256GB) from**

apple.com

REVIEW Issue 358, p48

OnePlus Pad

The OnePlus fully justified its place in our luxury tablet Labs thanks to its outstanding build quality, slick performance and stunning 17-hour battery life. It's the best Android option outside of Samsung's Galaxy Tabs – and it won't do nearly so much damage to your wallet.

£449 from oneplus.com

REVIEW Issue 352, p86

EVERYDAY PHONES

Motorola Moto G54 5G

Great looker for £180
from johnlewis.com

The 6.5in 120Hz IPS display is the G54's standout feature, but it improves on the previous generation in numerous ways while being even cheaper. It's faster, looks better, takes great photos and battery life is strong. You won't find better for less than £200.

REVIEW Issue 355, p77



Google Pixel 8a

We're fans of the Pixel 8 but you can save £200 and buy the 8a without missing out on any key features, including its advanced AI skills thanks to the same Tensor G3 chip inside. It's only when you zoom into snaps that you spot the camera quality difference.

128GB, £499 from store.google.com

REVIEW Issue 358, p74

Samsung Galaxy A55

Not the fastest phone on the market, but in return you get a high-quality 6.6in OLED display, excellent battery life and a trio of strong cameras. And you also get four years of feature updates. With a price that significantly undercuts the Pixel 8a, it's great value, too.

128GB, £364 from johnlewis.com

REVIEW Issue 358, p77

PREMIUM PHONES

NEW ENTRY

Samsung Galaxy S24 Ultra

AI cleverness from £1,249
from samsung.com

The undeniably high price gets you a bunch of AI tools that will genuinely save you time (and money). While we miss the 10x optical zoom of the S23 Ultra, the 5x zoom camera and supporting cast capture brilliant images, while the S Pen is always on hand to scrawl notes and pictures.

REVIEW Issue 354, p58



Honor Magic V3

With the Magic V3, not only does Honor make foldable phones as slim as flagship phones but also as affordable – so long as the £300 discount voucher still applies, as shown in the price here. What's more, the cameras and both OLED panels are superb. **£1,400 after discount from** honor.com

REVIEW Issue 362, p62

Motorola Razr 50 Ultra

Not merely a huge upgrade over last year's Razr 40 Ultra, this new model also leapfrogs over Samsung's new Flip6 to become our flip phone of choice. That's thanks to its great battery life, superb screens (particularly on the outside) and a camera that's a joy to use.

£1,000 from motorola.co.uk

REVIEW Issue 360, p88

EVERYDAY MONITORS

Iiyama ProLite XUB3293UHSN-B5

32in 4K bargain, £429
from currys.co.uk

The fact that this 31.5in IPS monitor could compete so well against Eizo's alternative (see below) says it all. Great colour coverage in sRGB and DCI-P3, USB-C and RJ45 inputs, plus solid build quality add up to a bargain.

REVIEW Issue 357, p88



AOC Q27B3CF2

AOC's relentless focus on value delivers a 27in 1440p screen with a high-quality IPS panel that costs £200 including VAT – and also packs in a USB-C port. Those are almost the only features you get, and the OSD is awful, but at this price we're not complaining.

£200 from amazon.co.uk

REVIEW Issue 360, p77

Acer Verso B277 Ebmiprxxv

This is a basic but high-quality monitor, delivering colourful images across its 27in Full HD diagonal. You don't get USB-C docking, but it includes VGA, HDMI and DisplayPort inputs, plus a two-port USB hub.

£149 from tinyurl.com/357acer277

REVIEW Issue 357, p84

PROFESSIONAL MONITORS

Eizo FlexScan EV3240X

Stunning 4K quality, £1,206
exc VAT from photospecialist.co.uk

With images that whack you between the eyes as soon as you lift it, fully assembled, from its box, this 32in 4K monitor is our top choice pick for anyone willing to make such a hefty long-term investment.

REVIEW Issue 357, p91



Eizo ColorEdge CG2700X

A brilliant choice for professional designers, whether working solo or in teams, thanks to its dedication to providing accurate colours across potentially years of life. It's also bang up to date for connectivity, with USB-C and RJ45 making it easy to manage, too. **£2,149 exc VAT from** wexphotovideo.com

REVIEW Issue 357, p90

BenQ PD2706U

If you can't stretch to Eizo budget levels then this 4K 27in screen is definitely worth investigating. It has several features aimed at professionals, including a Hotkey Puck to switch between profiles, plus great coverage of the sRGB and DCI-P3 gamuts. **£333 exc VAT from** scan.co.uk

REVIEW Issue 357, p86

WEBCAMS

Logitech MX Brio 705 for Business

Consistent brilliance for £219

from [logitech.com](https://www.logitech.com)

Consistent image quality in all lighting conditions coupled with top build quality and nifty features – such as a presenting mode for items on your desk – make this a fantastic all-round choice.

REVIEW Issue 356, p68



Logitech Brio 105 for Business

While you can buy 1080p webcams for a third of the Brio 105's price, they won't hold a candle to the Logitech webcam's quality – especially in low-light conditions, such as one candle. It's also easy to manage, for businesses and individuals.

£45 from [logitech.com](https://www.logitech.com)
REVIEW Issue 360, p77

Obsbot Tiny 2

This portable 4K webcam delivers for quality, design and sharpness, and it comes with a shedload of advanced features, including dynamic zoom and subject tracking. The only real downside is that it has a price that reflects its premium ambitions.

£329 from [amazon.co.uk](https://www.amazon.co.uk)
REVIEW Issue 352, p75

HOME OFFICE PRINTERS

Epson EcoTank ET-2830

Ink tank all-in-one for £250

from [epson.co.uk](https://www.epson.co.uk)

Don't expect flashy features, but do expect fast print speeds, high-quality prints, scans and copies, plus phenomenally low running costs – even after you've exhausted the 6,000 pages' worth of bottled ink that comes with it.

REVIEW Issue 353, p85



Canon Pixma TS8750

A fantastic choice for creative users that's equally at home printing photos as it is scanning artwork. Despite its high running costs, due to its reliance on cartridges, this is a superb all-in-one.

£159 from [printerbase.co.uk](https://www.printerbase.co.uk)
REVIEW Issue 353, p86

HP OfficeJet Pro 9012e

So long as your print volumes aren't huge – the running costs mount up – this is a superb all-in-one for home office usage. It's fast, robust, prints double-sided and produces strong all-round results.

£208 from [printerland.co.uk](https://www.printerland.co.uk)
REVIEW Issue 353, p87

WORKGROUP PRINTERS

Canon Maxify GX6550

Ink tank all-in-one for £392 exc VAT

from [canon.co.uk](https://www.canon.co.uk)

Designed to fit in tight spaces, this all-in-one includes a highly effective ADF and backs it up with high-quality prints at 24ipm in our tests. Running costs are superb, too.

REVIEW Issue 350, p58



Brother HL-L9430CDN

This laser printer (not an all-in-one, so there's no scanning or copying functionality) is a great choice for a busy office, producing sharp black text and making a good job of colour graphics as well. All while doing so quickly with a competitive price per page.

£415 exc VAT from [printerland.co.uk](https://www.printerland.co.uk)
REVIEW Issue 353, p84

Xerox B315DN

A fine alternative to the Brother and Canon, this mono laser multifunction printer produces superb results at great speed – 27.5 pages per minute in our 50-page test, which includes the spool time. It's similarly quick for scans, with a dual-CIS ADF to speed up double-sided copies.

£238 exc VAT from [printerbase.co.uk](https://www.printerbase.co.uk)
REVIEW Issue 341, p87

WIRELESS ROUTERS

Netgear Nighthawk RAXE300

Fast Wi-Fi 6E router, £350

from [amazon.co.uk](https://www.amazon.co.uk)

The RAXE500 is faster than the RAXE300, but in practice we doubt you would notice – this tri-band router still delivered speeds between 50MB/sec and 150MB/sec in our tests. And it's packed with features, too. At £150 cheaper than its bigger brother, we think it hits the Wi-Fi 6E sweet spot.

REVIEW Issue 341, p68



Netgear Nighthawk RS700S

Make no mistake – you won't get stunning speeds out of this Wi-Fi 7 router today. But if you must buy a router now and want future-proofing, this is a solid choice. But honestly, we would recommend that you wait.

£800 from [netgear.com](https://www.netgear.com)
REVIEW Issue 353, p76

Asus RT-AX59U

You can buy cheaper Wi-Fi 6 routers – such as the D-Link Eagle Pro AI R15 for £55 – but Asus' well-priced offering delivers strong performance along with lots of control and exceptional VPN support.

£125 from [uk.store.asus.com](https://www.uk.store.asus.com)
REVIEW Issue 350, p57

MESH WI-FI

TP-Link Deco XE200

Clever Wi-Fi 6E for £600

from [amazon.co.uk](https://www.amazon.co.uk)

There are cheaper Wi-Fi 6E meshes, but the XE200 wins for its superb download speeds, excellent coverage and the fact that older clients reap benefits of 6E, not just new ones. And a two-pack (code BOBKTDPCW8) should be enough for most premises.

REVIEW Issue 349, p65



Mercusys Halo H80X

A new subsidiary of TP-Link, Mercusys offers its parent brand's XE75 router some excellent value-for-money competition. Not as fast due to Wi-Fi 6 rather than Wi-Fi 6E, but it has all the bandwidth you need for everyday use and should deliver it stably throughout your house. There are plenty of features too.

2-pack, £161 from [ebuyer.com](https://www.ebuyer.com)
REVIEW Issue 341, p71

Linksys Velop Pro 6E

Ironically, this Wi-Fi 6E router will get the most out of your non-Wi-Fi 6 devices thanks to its use of the 6GHz network for station-to-station traffic. And you only need two units for rock solid performance across a three-bedroom house.

2-pack, £380 from [amazon.co.uk](https://www.amazon.co.uk)
REVIEW Issue 350, p54



BUSINESS WI-FI

Zyxel WAX640S-6E Wi-Fi 6E AP, £369 exc VAT

from broadbandbuyer.com

A nicely priced tri-band wireless access point ideally suited to businesses that want to provide the full range of wireless services. It's easy to deploy, wireless performance is good and Zyxel provides top-quality cloud management services.

REVIEW Issue 353, p100



TP-Link Omada EAP783

This slim-line discus has a mighty BE19000 rating and will appeal to businesses looking to make an early transition to Wi-Fi 7. It delivers superb performance and is MLO-ready, while TP-Link's Omada cloud platform offers great remote management services.

£520 exc VAT from senetic.co.uk

REVIEW Issue 360, p103

Ruijie Reyee RG-RAP2260(E)

This competitively priced Wi-Fi 6 AP delivers business-class features and impressive performance, and the free Ruijie Cloud service offers a wide range of remote network management and monitoring tools.

£160 exc VAT from broadbandbuyer.com

REVIEW Issue 359, p103

NAS SERVERS

Synology DiskStation DS1823xs+

10GbE NAS, £1,413 exc VAT

from broadbandbuyer.com

This powerful eight-bay NAS is a great choice for SMBs that want plenty of capacity, features and performance at a reasonable price. The new DSM 7.2 software has security high on its agenda, and the icing on the cake is Synology's generous five-year warranty.

REVIEW Issue 346, p101



Qnap TS-h987XU-RP

The TS-h987XU-RP is a ready-made hybrid storage solution for SMBs.

This rack-friendly package offers a great specification for the price, and Qnap's QuTS hero software scores highly for its wealth of data-protection features and business apps.

Diskless, £3,292 exc VAT from broadbandbuyer.com

REVIEW Issue 344, p96

Synology DiskStation DS1522+

Small businesses that want a high-capacity desktop NAS at a good price will find Synology's DS1522+ a great choice. Performance over 10GbE is impeccable and the DSM software offers a fantastic range of storage features.

5-bay NAS, diskless £586 exc VAT from broadbandbuyer.com

REVIEW Issue 344, p98

VIDEOCONFERENCING

Owl Labs Meeting Owl 4+ Magical meetings, £1,665 exc VAT

from owllabs.co.uk

For fully immersive meetings, nobody does it better than Owl Labs. The Owl 4+ sports a new 64MP fish-eye camera that boosts video output to 4K Ultra HD while keeping super-smooth speaker tracking. Pairing it with an Owl Bar covers every meeting room angle.

REVIEW Issue 360, p102



Poly Studio X52 with TC10

Ideal for businesses that want a professional videoconferencing solution for medium-sized meeting rooms. Video quality is excellent, speaker tracking is exceptionally fast, and the big choice of built-in VC apps makes it incredibly versatile too.

£3,161 exc VAT from meetingstore.co.uk

REVIEW Issue 353, p102

Jabra PanaCast 50

This sleek cylinder delivers great video and audio quality, fast speaker tracking and a wealth of advanced features. Jabra's Xpress web portal offers smart remote management services, and the super-wide view helps make the PanaCast 50 ideal for all-inclusive meetings.

£867 exc VAT from uk.insight.com

REVIEW Issue 354, p100

SCANNERS

Xerox N60w Pro Scanner

Speed demon, £766 exc VAT

from tradescanners.com

The N60w Pro offers tremendous value and versatility. It delivered up to 67ppm in our tests with great output quality, offers a plethora of connection options and makes walk-up scanning a breeze.

REVIEW Issue 358, p101



Brother ADS-4500W

Ideal for small businesses, the ADS-4500W offers a fine set of walk-up scan features and its output quality is beyond reproach, while Brother's Print&Scan app delivers great scan workflow management options.

£295 exc VAT from printerbase.co.uk

REVIEW Issue 358, p98

Epson WorkForce ES-C320W

A space-saving wireless desktop scanner, the Epson WorkForce ES-C320W delivers nippy speeds – around 31ppm in our tests – and is backed with software that offers plenty of scan management features.

£180 exc VAT from printerland.co.uk

REVIEW Issue 358, p100

SERVERS

Dell EMC PowerEdge T350

Xeon E-2300 power, from £1,399 exc VAT

from dell.com

Perfect for SMBs and branch offices looking for an affordable and powerful single-socket tower server. Along with support for Xeon E-2300 CPUs and lots of memory, it has a high storage capacity, plenty of expansion space and is sturdily built.

REVIEW Issue 335, p98



Dell EMC PowerEdge R250

With prices starting at around £850 exc VAT for a Pentium Gold CPU, and the option of Xeon E-2300 series chips from £1,461 exc VAT, this is a slim, rack-mounted alternative to the more high-powered T350 that's ideal for SMBs.

From £845 exc VAT from dell.com

REVIEW Issue 332, p98

Broadberry CyberServe Xeon E-RS100-E10

This represents a powerful hardware package at a price that will please small businesses. We love its low-profile chassis and the fine selection of remote-management tools. It's a great alternative to the Dell EMC servers also listed here.

£983 exc VAT from broadberry.co.uk

REVIEW Issue 318, p96

SECURITY SOFTWARE

Avast Ultimate

Buy from retail and this is a bargain, with a solid VPN, anti-tracking software and handy detection fees on top of excellent protection. **10 devices, 2yrs, £30 from store.pcpco.co.uk**
REVIEW Issue 355, p84



G Data Total Protection

G Data provides straightforward, effective and inexpensive protection against malware and other threats to your system, making it a favourite despite its quirks. **5 devices, \$82 from gdatasoftware.co.uk**
REVIEW Issue 355, p87

Avast One Essential

Avast One Essential has the same malware-detection engine as our top choice, but for free. It even includes 5GB of VPN services per month and a few system optimisation tools. **Free from avast.com**
REVIEW Issue 355, p89

VPNs

Surfshark

Reliably fast and goes out of its way to ensure that international streaming services work. Surfshark has a credible track record for privacy, too. **£55 for 27 months from surfshark.com**
REVIEW Issue 360, p87



NordVPN

One of the best all-purpose consumer VPN services around, and the paid-for version is packed with features – from anti-malware tools to a rather clever mesh file-transfer system. **£94 for 27 months from nordvpn.com**
REVIEW Issue 360, p85

Proton VPN

A great VPN in its own right, but also the best free VPN service as you get unlimited data. Instead, Proton restricts which endpoints you can access to only three countries: the USA, the Netherlands and Japan. **Free from protonvpn.com**
REVIEW Issue 360, p86

PASSWORD MANAGERS

NordPass

This hassle-free option is a great choice for both personal and business use, with a competitive price matched with all the features most people need. **£1.89 per month from nordpass.com**
REVIEW Issue 350, p70



Bitwarden

Free for individual use and open source, the only important thing Bitwarden lacks is phone support: it works with virtually every device and browser, and the paid option is well worth £10 per year. **Free from bitwarden.com**
REVIEW Issue 350, p71

Keeper

A great choice for businesses thanks to its focus on security and a zero-knowledge policy, and if you need more options then Keeper has them. **Business edition, from £2 per user per month from keepersecurity.com**
REVIEW Issue 350, p72

ON-PREMISES BACKUP

NEW ENTRY

Nakivo Backup & Replication 10.11.2

Perfect for SMBs that want the freedom to choose their host system. It supports an incredible range of hardware platforms and OSes and is packed with data protection features. **Enterprise, 10 servers, perpetual licence, £1,118 exc VAT from nakivo.com**
REVIEW Issue 362, p100



CLOUD BACKUP

IDrive Business

A top cloud backup choice for SMBs that want to protect on-premises systems and remote workers. Platform and business app support is outstanding, it's easy to use and the simple capacity-based subscriptions are incredibly good value. **5TB, £838 exc VAT per year from idrive.com**
REVIEW Issue 359, p101



VOIP SERVICES

3CX Phone System V20

Our top choice for businesses that want to manage their own VoIP system. It can be hosted in the cloud or on-premises, and has lots of new features. **Small Business, 10 users, £175 exc VAT per year from 3cx.com**
REVIEW Issue 357, p98



Veritas Backup Exec 23

Backup Exec 23 is easy to manage, provides valuable ransomware protection and the subscriptions are great value. **Simple Core Pack, 5 instances, £498 exc VAT per year from uk.insight.com**
REVIEW Issue 362, p101

NEW ENTRY

Acronis Cyber Protect 16 Advanced

Flexible subscriptions keep costs under control, the EDR service stays one step ahead of cybercriminals and it's easy to manage, too. **From £95 exc VAT per year from acronis.com**
REVIEW Issue 359, p98

TelephoneSystems.Cloud

A great choice for businesses that know what they want from cloud-hosted VoIP services, offering a wealth of features at a competitive price. **From £11 exc VAT per user per month from telephonesystems.cloud**
REVIEW Issue 357, p100

NETWORK MONITORING

Progress WhatsUp Gold 2023.1

Simple to deploy and offers an impressive range of network-monitoring tools. The choice of licensing plans makes it an affordable option for SMBs, and support teams will love its smart dashboard and NOC views. **Enterprise, 50 devices, £1,192 exc VAT per year from whatsupgold.com**
REVIEW Issue 354, p99



Paessler PRTG Network Monitor 23.4

A highly versatile network-monitoring package that delivers a wealth of information, and its all-inclusive price makes it a great choice for SMBs. **1,000 sensors, 1yr maintenance, £2,649 exc VAT from paessler.com**
REVIEW Issue 354, p98

REMOTE SUPPORT

NetSupport Manager 14.1

Sets the standard for on-premises hosted support for local and remote workers. It delivers a remarkable range of features and its one-time cost per seat will appeal to businesses concerned about subscription fees. **1-500 systems, perpetual licence, £10 each exc VAT from netsupportmanager.com**
REVIEW Issue 361, p100



ISL Online Standard

Perfect for SMBs wanting cloud-based support. Features and access security are excellent, as are its flexible licensing plans. **Standard Cloud/One user, £287 exc VAT per year from islonline.com**
REVIEW Issue 361, p99

SECURITY APPLIANCES

DrayTek Vigor 2927Lax-5G

SMBs and remote offices that demand always-on internet access will love this affordable security router. It offers an unbeatable set of WAN redundancy features and adds extra value thanks to its built-in Wi-Fi 6 services. **£667 exc VAT from broadbandbuyer.com**
REVIEW Issue 360, p98



WatchGuard Firebox M390

Combines strong performance with an incredible range of security measures all at a competitive price. **Appliance with 1yr TSS subscription, £4,273 exc VAT from broadbandbuyer.com**
REVIEW Issue 360, p100



He who smelt it isn't an artificial intelligence being



Dick Pountain is editorial fellow of *PC Pro*. He believes that a rose by any other name would smell mostly of beta-phenylethanol. Email dick@dickpountain.co.uk

The technology of smell is becoming more attractive to investors and researchers alike, but don't expect progress at the speed of light

I have no qualms in claiming that I have a better (or at least, better-trained) sense of smell than the average citizen. That's mostly because I studied organic chemistry in the 1960s. During my first few weeks of working in the cavernous college lab, I was instructed to learn the odours of a dozen common chemicals, and advised to employ smell as the first step in recognising any new compound. I can often tell an aldehyde from a ketone by sniffing, and became briefly addicted to ionone, cinnamaldehyde and menthol in succession, carrying little specimen tubes in my pocket. I'm sure this method is no longer taught, on health and safety grounds, as there are many substances that can kill at one sniff.

In later life this training came in handy when my brother-in-law Pip founded the Scotch Malt Whisky Society and was writing a book that needed to categorise the nose of various famous spirits. Odour is now a huge business, not merely for perfumes as it has been for centuries but for those hundreds of flavourings contained in most supermarket foods, which are manufactured in a huge chemical works in New Jersey. But smell has barely impinged upon the computer business so far, apart from the smell of burning insulation, which most of us quickly learn to recognise (and investigate).

I wrote semi-humorously in an earlier column about the possibility of a "sminter" loaded with an assortment of smelly "inks" that could be triggered via internet messaging, and I even got a letter some years later about an (unsuccessful) attempt to build one. Even Hollywood had stabs at

odour-enhanced films, with the 1960 Smell-o-Vision movie *Scent of Mystery* by Mike Todd Jr the most famous, but the obstacles in both cases were the same. For one, smell is a chemical, not electronic, signal that moves at the speed of breeze rather than light – and you can't just switch it off quickly.

A far more serious obstacle is that while the components of human light perception are threefold – red, green and blue retinal cells – the components of smell perception are vastly more numerous. Our noses contain at least 400 chemical receptors, and individual smells are recognised by trillions of combinations of their outputs, which release a plethora of proteins that are still not entirely understood.

Now, when you hear the word "trillions" nowadays, you're usually either talking about a generative pre-trained transformer (GPT), or possibly Nvidia's market cap. Understanding smell perception, like protein folding and DNA sequencing, is a perfect candidate for AI to analyse, so it comes as no surprise to learn (via an article in *Nature* that you can read at tinyurl.com/362nature) that many teams are working toward this end, with ample financing from industry.

The problem has several aspects: predicting a molecule's smell from its structure; decoding the response of human odour sensors to particular compounds; and automating comparison of smells of mixtures by identifying their components.

The current hot variant of AI – the GPT – works using the mathematics of parameter spaces: identify the

important parameters of the subject to be analysed, apply tensor calculus to create a multidimensional space with a dimension for each parameter, and then map training examples into this space. For

“Real progress is being made and AI may soon speed it enormously, but smell remains the least understood of our senses”

graphical AIs such as Stable Diffusion and Midjourney such spaces already have trillions of parameters for identifying shapes in visual worlds.

One problem for applying this to smell is getting training data: odour receptors, whether human or animal, are hard to study, as they often won't work outside the creature, and the amount of protein released is minuscule. Two receptors from insects and two from mice have been deciphered in the past year, leaving just 400+ more to go. A team at Duke University in North Carolina is using AlphaFold and machine learning to screen millions of chemicals for binding to two synthetic receptors they've engineered. A very important motivation for such work is to use smell recognition in diagnostic medicine by identifying odour molecules produced by disease processes (dogs are doing this already). Precisely how and where odour nerve signals are processed in the brain is leading-edge study right now.

Real progress is being made and AI may soon speed it enormously, but smell remains the least understood of our senses, and the least amenable to digital manipulation. It's so subjective that human tasters and perfumiers will retain an advantage over automated solutions for far longer than most professions; I don't expect to have to consult my laptop when I'm mixing our own custom bath oil from my little box of tubes of neroli, rose, ylang-ylang and sandalwood oils. Plus several other secret ingredients, none of which I will reveal to you or a data-sniffing GPT.

dick@dickpountain.co.uk

“Smell has barely impinged upon the computer business so far, apart from the smell of burning insulation”

Data should expire but try telling that to companies



Nicole Kobie is PC Pro's Futures editor, and after writing this column she sent a complaint to the Information Commissioner's Office. Apparently, it will take 14 weeks for them to read it. X@njkobie

A website I haven't used in years leaked my data, but that's only one part of the problem – why does it even still hold it?

A few years ago, I got bored and – after being plagued by ads – signed up for a clothing site called Lookiero. Answer a quiz on your fashion preferences and Lookiero would shop for you, sending a box of shirts, trousers, dresses and so on to try on at home. Pay for what you keep, send the rest back.

I did it a few times, got bored, and forgot about it. Then, last month, I received an email from HaveIBeenPwned, which watches for your details in leaked data, followed by a similar email from Google's Dark Web scanner. Lookiero, it would seem, had been hacked. It never sent a breach notification email, but when I checked the site it showed a message admitting "unauthorised access" that was "limited" to name, surname, email and even my address.

Oh, and also my phone number. The last few weeks I've had a series of calls from scammers. They are thankfully terrible at their criminal profession of choice, so I easily avoided being defrauded.

But I'm still angry. If, when I signed up for Lookiero, I'd been told

“Getting a box of clothes was fun, but it wasn't worth this much work, or the scam calls”

that the price for this service would be a week of scam calls, I would have closed my browser window. The service wasn't worth this hassle, either to me or the 4.9 million other accounts that were leaked. And, according to HaveIBeenPwned, this is the first breach to leak my home address. Thanks, Lookiero.

Google suggested my password was also compromised. So I headed to Google Password Manager for a checkup. I usually let Google choose a

strong password for me, but I do have some self-created credentials – and, idiot that I am, reused passwords.

This is my own fault, but I have my excuses. Some accounts I access via an app, so I use an easy-to-type password rather than having to log in to Google, copy the strong password, send it to my phone, and then paste it into the app in question. Call me lazy, but come on. Other weak credentials are left over from the days before I used a password manager.

After the Lookiero hack, I had 21 accounts showing in Google Passwords as potentially compromised, using the same username and password as leaked credentials. It's not as bad as it looks: for many, I long ago updated the password, but Google didn't know that. Others are for sites that no longer exist, so little risk there. Two of the websites protected me against myself: I hadn't signed in for ages, so wasn't able to without resetting my password.

A few websites I couldn't even remember signing up for – alarming on many fronts – including a ticketing CRM called Spektrix. Its website says it's because I bought tickets from a performing arts organisation that uses Spektrix, whom I must contact to change my password. But I don't know which it is, and there's nothing obvious in the

list. So that's just going to have to stay in the compromised list for all eternity.

I also apparently have an account at BuzzBingo. I've played bingo once in my life, and it was in person several years ago. To close my account, I have to call them. Are you kidding me? Of all things, an account at a gambling site should be easy to delete.

Indeed, all unused accounts should just fade into nothingness after a set period of time; I have emails from a few quality websites that do this.

That's actually a GDPR requirement, but companies don't seem to care about data minimisation.

I shouldn't be sitting here updating passwords for websites I haven't used for years. I should be able to hit a button to wipe all my personal data, and hit another button to delete my account outright. In reality, I will need to email every company on my list asking them

“I'm going to rethink signing up for accounts in the first place. Why am I trusting these companies to hold my data safely?”

to delete my data, as per GDPR. I'm going to do it, too.

But I'm also going to rethink signing up for accounts in the first place. Why am I trusting these companies to hold my data safely? That's an impossible ask, so they should keep as little data as possible. From now on, I'll check out as a guest if the option is available, and use Apple's Hide My Email when not. And I'll not sign up for sites on a whim. (This will probably save me money in the short term, too.)

Good companies that respect their users' safety should clear out old data and delete unused accounts as they age. Those that don't, such as Lookiero, put their own customers at risk merely for trying their service once a long time ago.

Getting a box of clothes was fun, but it wasn't worth this much work, or the scam calls, or having my address online. What's worse is I have 500 accounts listed in my Google Password Manager, and I'm sure many more that aren't collected there. I'm terrified of the data leaking from these digital buckets.

work@nicolekobie.com

Won't someone save us from email hell?



Barry Collins is a former editor of PC Pro. Send him an email. Why not? He loves the stuff. barry@mediabc.co.uk (apologies if it's lost in the spam queue). [@bazzacollins](https://twitter.com/bazzacollins)

Email apps are riddled with basic failings that make managing multiple inboxes a needless chore

You may have picked up on this over the past 25 years or so I've been writing here, but I'm not one of life's relentlessly cheerful sorts. I don't bound out of bed of a morning, whistling "Bring Me Sunshine" before updating my Facebook page with a post about "attacking the day". It ain't me.

One reason for this Eeyoreish demeanour is that when I park my backside on the faux-leather office chair at 8am each morning, I have to deal with my email inbox. Invariably, more than a hundred messages have landed overnight, the overwhelming majority of which are a waste of time and disk space, dragging my mood into the gutter before I've taken the head off my first latte.

How is email still this bad? Here's just a cross-section of the horrors that were in my mailbox this morning. Four identical messages from the same PR firm; 13 messages that are so obviously spam they might as well use the subject line "Nothing to see here"; a meeting reminder for an event that took place last night; and, of course, an invite to upgrade to LinkedIn Premium. It used to be said that Royal Navy commanders should listen for the shipping forecast on Radio 4 if they suspected nuclear war had broken out; now they just check their Gmail to see if LinkedIn is still offering a 30-day free trial to ensure the Russians haven't gone berserk.

I use Outlook on my Mac because (a) I'm a masochist and (b) it's still the best of a stupidly long list of email apps I've experimented with over the years, including Apple Mail, Thunderbird, Spark, Vivaldi Mail,

Gmail's web interface and more. Largely because it's the only app that allows me to reliably search back through the four different mailboxes I'm forced to monitor.

Now granted I don't (yet) have any AI gubbins running on my email accounts, but none that I've seen comes close to offering what I want. Still, in 2024, it shouldn't require any AI special sauce to hide duplicate messages, or weed out the spam from 13443534trdf@gmail.com offering me a grand piano, or to bin reminders for meetings that took place ten hours ago. This isn't asking for the moon on a stick.

In fact, Microsoft's spam handling is so bad it even bins messages I send to myself. The other day I was setting up a new Windows PC and needed a link for a BIOS update that was in my work email account. So I pinged it to my Hotmail account (the one linked to my Microsoft account, which I use to sign into all new PCs I test) and waited... and waited... until I finally delved into the Junk Email folder and found it lurking there. Even though that same Hotmail account had received messages from my work account many times before. What kind of warped logic blocks that but lets through messages from randomstring@gmail.com offering me Elton John's ivories?

No doubt after this column is published that email count will climb as a consequence of PRs begging me to try their killer new email service that automatically ferrets away the bad stuff and delivers the good, but it's staggering how many new-age

email services I've been pitched that refuse to get their hands dirty with IMAP accounts. Or, worse, have exceedingly vague privacy policies that means they could be

“Email is tedious to manage, has too many basic failings and routinely has me swearing like a sailor before the 9am watershed, let alone the 9pm one”

doing anything with your email. I'm resigned to that with my personal Gmail, but I can't risk it with client emails for my business account.

My ideal solution would be a local AI app that sat there quietly monitoring what's dropped into my various inboxes, ready to deliver a precis of what I've missed in the time I've been away. These are the 96 messages you can probably ignore for now, these are the five you're likely to care about, this is the one that needs a reply before 9am. Nothing in that is beyond the wit of today's LLMs. Indeed, when I manually copied 20 emails into a document and asked questions about them using Anything LLM with zero training, it did a decent job of working out which messages were important and which were flam – all processed locally on my Mac.

Email has been a drag on our work lives for too long. It's tedious to manage, has too many basic failings and routinely has me swearing like a sailor before the 9am watershed, let alone the 9pm one.

If you're about to pipe up that Slack or Teams or some other modern equivalent is a strong replacement for email, please sit down again, as nobody likes to be poked in the eye by an irritable journalist.

We need better email, and nothing I've suggested above falls into the realm of unicorns on mopeds; it's perfectly doable with today's technology. Please, for the sake of my sanity, somebody make it happen.

 barry@mediabc.co.uk

“It shouldn't require AI to hide duplicate messages, or to bin reminders for meetings that took place ten hours ago”

DrayTek



Vigor 2927Lax-5G

The DrayTek Vigor 2927 series Dual-WAN Load Balancing Firewall VPN Routers allow you to make the most of FTTP Fibre Broadband with Gigabit WAN throughput, extensive Firewall, Content Filtering, VPN client/server and Quality of Service controls.

- 5G/LTE Router with Dual Slim Slots
- Ideal VPN Router for SMB
- Dual Gigabit WAN Load Balancer
- Wi-Fi 6 - AX3000 Performance
- 5+1 Gigabit LAN Ports with VLANs
- High Availability
- VigorACS SD-WAN Central Management
- Centralised LAN Management
- Hotspot Web Portal

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Readers' comments

Your views and feedback from email and the web

30 years and counting

I wanted to get in touch regarding *PC Pro* celebrating 30 years of publication. As a long-term subscriber I am sure I speak for many when I say congratulations and thanks for being such a reliable source of IT news. I've often found the magazine very illuminating about technology that I am not normally exposed to as part of my day job.

For a bit of fun I recently bought a large number of old copies of *PC Pro* from eBay (including issue one, right) and have found them fascinating reading, how the technology has changed so dramatically in 30 years. Especially technologies such as the internet and operating systems, the internet being met initially with cautious optimism to a few issues later including guides to helping people get online and recommending websites. I'm sure the magazine has helped clear the confusion of many new technologies over the years for people, and for readers to pick up on current trends.

However, an article looking forward to the 2000s in 1996 wasn't quite as accurate, although back then no-one saw the changes coming thanks to Mr Jobs! Thanks for the great reads, I hope there are many more to come! **Richard Healey**

30 years ago...

I really can't believe this magazine has been going for 30 years. I remember back in 1994 when I was looking for a video projector to help get presentations across to a wider



ABOVE Issue number 1, still available on eBay if you're lucky!

audience as part of my job in the fire service, the magazine had a top ten of video projectors listing the pros and cons with lots of technical details. I've subscribed to the magazine since then and have used it as a resource to justify spending on all of my IT requirements, to employers and, more importantly, to my wife.

This includes PCs, mobile phones (I'm a big fan of OnePlus thanks to you), video projectors for

work (again), routers, printers and many more IT-related hardware products. I also use the magazine to keep up with software products available for use at home. So I would like to take this opportunity to say thank you for your help and guidance over the last 30 years and long may it continue. **Stewart Jones**

Editor-in-chief Tim Danton replies: Thanks to both Richard and Stewart for your kind words about the magazine. All of us at *PC Pro* have been touched by everyone's kind messages. If anyone wishes to join us in person for a celebration, we're recording a one-off live podcast on the evening of Thursday 10 October in central London. Join our Discord server (pcpro.link/discord) and see the 30th_anniversary_meetup channel for more information.

They're watching

Silicon Valley companies have subtly enforced tracking upon us, without most people agreeing or in most cases

even aware. My Google Timeline tells me my exact travels on each day. Even if I turn off Location History or delete location data, other Google services may still retain data based on my device's general area and IP address.

In any case, my phone can just check the SSID of neighbouring networks and work out where I am from this without recourse to GPS. And many apps will record your exact location so they can do neat things like telling you where all your friends are or recommend a local restaurant.

Perhaps the solution is to buy an old Nokia, the one with a seven-day battery life? That won't help, I'm afraid: a quick triangulation from the exact time your mobile signal arrives at two different masts and the network operator can work out your location.

I suspect you're thinking, "why have a mobile phone at all? Just drive off into the sunset leaving your phone at home." Did I forget to mention the location logging fitted to most modern cars? **Nigel Osborn**

I was wrong!

Never let my wife read me saying this as she doesn't think I know how to form the words, but I was wrong. In last month's Readers' Poll, you asked about AI and its general usefulness, and I said "a solution in search of a problem". Pithy and verging on smug. However, I've just redesigned my Noise Chap website and wanted to add a calculator for working out daily noise exposures from multiple noise sources and durations.

Decibels were invented by a fella who was clearly off his head on something highly hallucinogenic as it

Star letter

IT and food

By coincidence, a few weeks before the CrowdStrike fiasco, I had read Robert Harris' brilliant novel, *The Second Sleep*. When you start reading you think it's about medieval times, but you quickly realise that this is a post-apocalyptic novel set some centuries after a catastrophe that destroyed our modern world. Our hero, a young priest, discovers an old document that speculates on the reasons for the catastrophe.

As well as the reasons we might expect, such as nuclear war and climate change, one possibility that seems very likely is the collapse of the world's IT systems, in particular, supply chain systems. If this sounds far-fetched, the UK is totally reliant on imported food and just-in-time purchasing means that the UK has only a few days' stock of food. If food supplies to the UK were to stop, within a very short time, civil order would break down, riots and fighting over the remaining food stocks would break out and millions would die.

I have to confess some responsibility for this, because my former company, Business Computer Projects, sells food distribution systems whose

main selling point is the very accurate demand forecasting algorithms that allow food distributors to cut stock to the absolute minimum.

Fortunately, although the CrowdStrike problem affected many important systems, it didn't hit food distribution, but it's not hard to imagine scenarios that would. I'm not sure of the remedy for this over-reliance on technology for almost everything, but incentivising local food production should possibly be one. Another would be treating the food supply chain as an essential service, with perhaps regulation to ensure that major food importers have backup plans in place to cope with IT system disruption. **Brian Preece**



This month's star letter writer wins a Cherry KC 200 MX mechanical keyboard, worth £80, recipient of a five-star review and a *PC Pro* Recommended award. Email letters@pcpro.co.uk

makes no sense whatsoever when you start adding them together, although I am sure it is the kind of thing Mr Honeyball does for fun. I grew up in Wigan in the 1980s where a proficiency in Maths was being able to say "fares please" and give the right change for a fiver. My coding ability also stopped at around HTML3, so I was a bit stumped.

I turned to ChatGPT and asked it to write the code to create an online calculator for daily and weekly noise exposures from multiple sources, and it did. A simple copy and paste of the code into a Squarespace page, tweak it to look pretty(ish) and it all works.

So I take it all back. I found the problem I needed a solution for and it was utterly marvellous. If it was a person I'd buy it a beer for that.

So I am now veering towards the "excited" end of your original poll. Is it too late to change my vote? **Adam Jackson**

Bottoms up

Steve Cassidy's column (*see issue 361, p120*) reminded me of a story I heard long ago. The company had just implemented a new system for office staff called "Total Office Productivity System", or TOPS. The staff all joked that when it failed, they had to resort to BOTTOMS – Back On To The Old Manual System. **John Gwatkin-Williams**

Out of ink?

I'm enjoying my first read of issue 361 from my local library in the USA. In the Readers' Comments section I see a reader wrote "Live long and print" and had problems printing black ink only. Someone should have commented that when printing black only, colour ink is often used unless you go into the Printer Properties and select black ink only. For my Epson printer choosing Black/Grayscale won't use colour ink.

David Maurice

Contributing editor Lee Grant replies: You've highlighted an oft-overlooked quirk with printers. Essentially, with CMYK, there are two ways to print black. The first is to only use the black cartridge. The other is to blend all colours with black to make "Rich Black". Possibly named due to deluxe blacks being splashed over the page, or perhaps a boardroom joke for the extra revenue in consumables.

Some manufacturers allow isolation in the settings (as you've found), but others don't. A reminder to everyone that a dig around in the printer settings could save a few quid.

Readers' poll

Out of these three main activities, which do you use your smart speaker for the most?

15%
ANSWERING QUESTIONS

44%
SETTING TIMERS

41%
SMART HOME CONTROL



We asked this poll on X, which annoyingly restricts the number of choices to three. This meant we couldn't include listening to music and radio in our options, but it was soon clear from responses that this was the other major use of the technology.

"The one in the kitchen is used for cooking timers and playing music," said Lee Jordan. "The one in the bedroom is just for Radio 4." And while Dave Rutt uses his "almost exclusively" to play Scala Radio, Andrew Pepper in Cyprus finds his a great way to "listen to the BBC channels".

We did like ElvisKremmen's response, too. "Timers mainly, sleepy music at bedtime and sending my kids hugs." Meanwhile, Stuart Hughes plays radio for the dog when they're out, and a certain Davey Winder uses his "to test how best to combine obscure swear words".

Then we come to Ian D Nock, who uses his smart speaker for smart home control and much more besides. But: "The question to also ask is, 'if they went away, what would you do?' And the answer is, figure out an alternative solution because they're needed. Yes I would pay some extra money for better features, but the devil is in the detail – it is not worth £10 per month, for example. Maybe £30 per year."

We can't finish this without tackling the point made by Lincolnshire Rebel on X (@LNSRBL23). "Don't have one, and won't have one. These are ALWAYS listening, and I simply don't trust the likes of Amazon and Google. We need to be having a much more involved discussion about personal privacy and technology."

“Used to play music, now its main function is ‘hey Google, find my phone’” **Tim Pass**

“Being English, I am obliged to ask frequently what the weather will be.” **Tom Dickson**

“Pretty much two commands: Alexa, what's the weather today? Alexa, play Planet Rock.” **Steven Croucher**

“Turning the bedroom light on and off. But 99.9% is listening to audiobooks and podcasts.” **David Wright**

“Great for the radio and timers, pretty much useless for everything else.” **@millmeister**

“Smart home: turns on the upstairs electric blanket.” **Charles Dytham**

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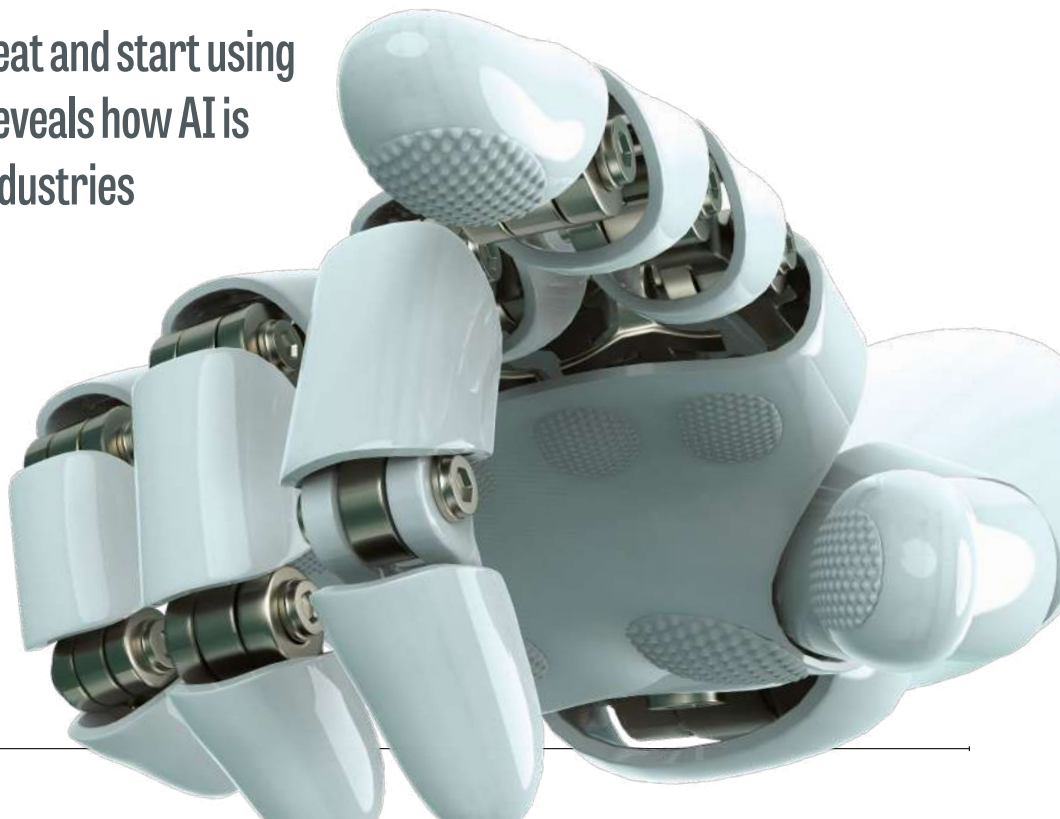




AI WANTS YOUR JOB!

And that's fine: let it do the dull stuff, add new skills and make you richer

Stop thinking of AI as a threat and start using it for work. **Barry Collins** reveals how AI is being used in a variety of industries



There's a dismal tendency with every new technological development to regard it as a threat. Computers, the internet and now AI have all been heralded as a threat to our livelihoods, ignoring our unshakeable ability to adapt.

Yes, AI will likely take many jobs. It already has. But it can also be a tremendous assistant in the workplace, a technology which – if mastered at this still early stage – could lead to you becoming indispensable, rather than ready for the scrapheap.

We've interviewed people who are using AI across a wide cross-section of professions to find out how it's transforming the way they work. From teachers saving hours on lesson planning, to a gardener despatching invoices from voice memos, to market researchers using AI to rapidly scale the quality of research they're able to conduct, AI is making an enormous difference in the workplace. And almost all the people we've spoken to are using AI tools that are available to everyone for free or at a relatively modest cost.

By all means spend your time fretting over when AI is going to take your job. Or get ahead of the curve and find out how to exploit it for yourself. You never know, it might just work out.



TEACHING

Teaching is one of the professions that has been most disrupted by AI becoming mainstream. With students able to generate essays in seconds – complete with convincing-looking typos and grammatical errors if you know the right prompts – the profession's response has often been defensive, looking for ways to combat AI rather than embrace it.

Others are taking a more open-minded approach, finding ways in which AI can enhance learning. Robert Harrison, director of education and integrated technology at ACS International Schools, is among those using AI to lift the burden on teachers, rather than treat it as the enemy.

Two of the big admin headaches for teachers are lesson planning and report writing, two areas in which AI can lend a hand. There have long been websites where teachers can download lessons plans created by their peers and tweak them for their

own needs, but it's a time-consuming process. Both the mainstream AI providers (ChatGPT and Google) and specialist providers are stepping into the breach, using AI to create tailored lesson plans rather than adapting someone else's slides, for example.

"There are a couple of providers who do this really very well for us, whose native product was about collaboration," said Harrison. "They have lots of teachers who collaborated in the past... and so they can use that knowledge base to generate lots of really good and relevant ideas that are already lined up with your teaching philosophy."

"It's a curated set of materials from which to work, and it can work intelligently and learn what teachers do as they refine the lesson. Then that machine learning goes back into

ABOVE AI can take mundane tasks such as lesson planning out of teaching

the algorithm to produce better results for people the next time."

The AI can go a step further, creating specific lesson plans or exercises for students with different needs. Previously, time constraints on teachers may have made it difficult to create bespoke plans for different abilities within a class, but the AI is able to generate tweaked lessons more quickly. "If your students' profiles include a number of students who have an auditory processing disorder, for example, you may be able to look for a learning strategy which addresses their particular learning needs," said Harrison.

"Or if you have a student who has dyscalculia and so is unable to function with particular number patterns, you can generate specific exercises which allow them to practise and to strengthen that particular learning ability."

It can work intelligently and learn what teachers do as they refine the lesson



Schools do, of course, have to be particularly careful around data protection and not enter any personally identifiable information about a pupil's ability into an AI system that doesn't have sufficient safeguards. "I think it will become like most things in the ed tech industry: you will have to pay your money and take your choice, but do a lot of your own educator consumer research as to what's good value for money and who's actually working ethically with you," said Harrison.

Lesson planning isn't the only teaching admin job that AI is helping with for the ACS schools. It's also taking some of the time-sapping work out of student reports, with AI systems used to proof-read the reports before they are sent to parents. Harrison describes this as a "spell check on steroids".

The AI can make sure the teacher doesn't make potentially insulting errors, like referring to the wrong gender in their comments about a student, for example. Previously, headteachers or other school leaders would "spend a lot of time proof-reading and going through their teachers' comments as a quality assurance measure," said Harrison. "That could be outsourced to machine really pretty easily, and we're having good success with that."

He added that the school has been "transparent with parents that we don't all have the privilege of having an executive assistant, but technology can give some of that power to teachers".

It's not only teacher admin that will be eased by AI, but parent admin, too. Anyone who has school-age kids will know the horror of getting a dozen different emails each week, asking for contributions to trips, reminding you about after-school activities, or amending the uniform policy, all of which are forgotten within seconds of landing in your inbox. Well, AI might soon save you from having to plough through those emails ten minutes before you shove the sprogs out of the door on a Monday morning. "We're not there yet, but we're hoping to develop AI applications with which you can open the school's chatbot," said Harrison.

"It will know who you are. You can say what time is my daughter supposed to be at choir practice tomorrow, which could [otherwise] mean looking through six newsletters or for three text messages in a WhatsApp group. But if the knowledge base is there, that closed universe is also possible."

I think I speak on behalf of all parents when I say: please make this happen. Yesterday.

Pretty much every team in the business cites that as something that they found really valuable



LEGAL & HR

Nobody could accuse Advania of not eating its own dog food. Well, Microsoft's dog food.

Advania is a technology services company and Microsoft partner, which advises companies on how to implement various Microsoft products, including the Copilot AI. Which is one of the reasons why the company decided to roll out Copilot to each of its 1,000+ employees and see what they would do with it.

There were some common uses of the AI to which almost everyone in the company gave a big thumbs up. Things like having the AI sit in on Teams meetings, creating an auto-generated transcript of the meeting with a summary and action points. "I would say that pretty much every team in the business cites that as something that they found really, really valuable," said Chris O'Brien,

ABOVE AI is cutting workloads for legal teams and HR departments

Advania's products and services director, and a Microsoft MVP.

However, there were also specific uses for individual departments that really stood out, not least within the legal and HR teams. "Our legal team are using it for contract reviews, to help identify potentially dangerous things in this contract that are outside of our norms," said O'Brien.

"They're using Copilot to identify things like where the liability cap is a lot higher than what we would accommodate, or clauses in IP ownership that are different to what we would want."

The ability to train Copilot on the company's own data also comes in handy for the legal team when they're reviewing such contracts. "They're now putting every contract through Copilot and often cross-referencing a 'known good [contract]', having it do the analysis," he added.

HR is also putting its Copilot accounts to good use. "We're a business of 1,200 people across the UK and South Africa," said O'Brien. "Our HR team is scaled for that, but what we're trying to do is scale



differently. As we hire the next 100 or 200 people, let's maybe try and scale these supporting functions in a lower way. And what they [HR] say is they just never draft a new communication, or policy, or a job description, or even the selection process for a role. They would just never write that from a blank sheet of paper any more. They are always starting with Copilot."

The AI also plays a role in "sensitive meetings", where staff may have previously recorded the audio from such a meeting or taken notes. "They're using Copilot to record the call and generate the legally required consultation notes," said O'Brien.

Copilot isn't perfect, and "occasionally there's a point that gets dropped that needs to be on there", meaning staff have to carefully check each set of AI-generated consultation notes. But, according to O'Brien, the HR team say that "what we're now doing is the 10% rather than the 100%".

CUSTOMER SUPPORT

Before we leave Advania, there's another use for Copilot that the company didn't anticipate when it rolled it out across the fleet: helping to provide customer support.

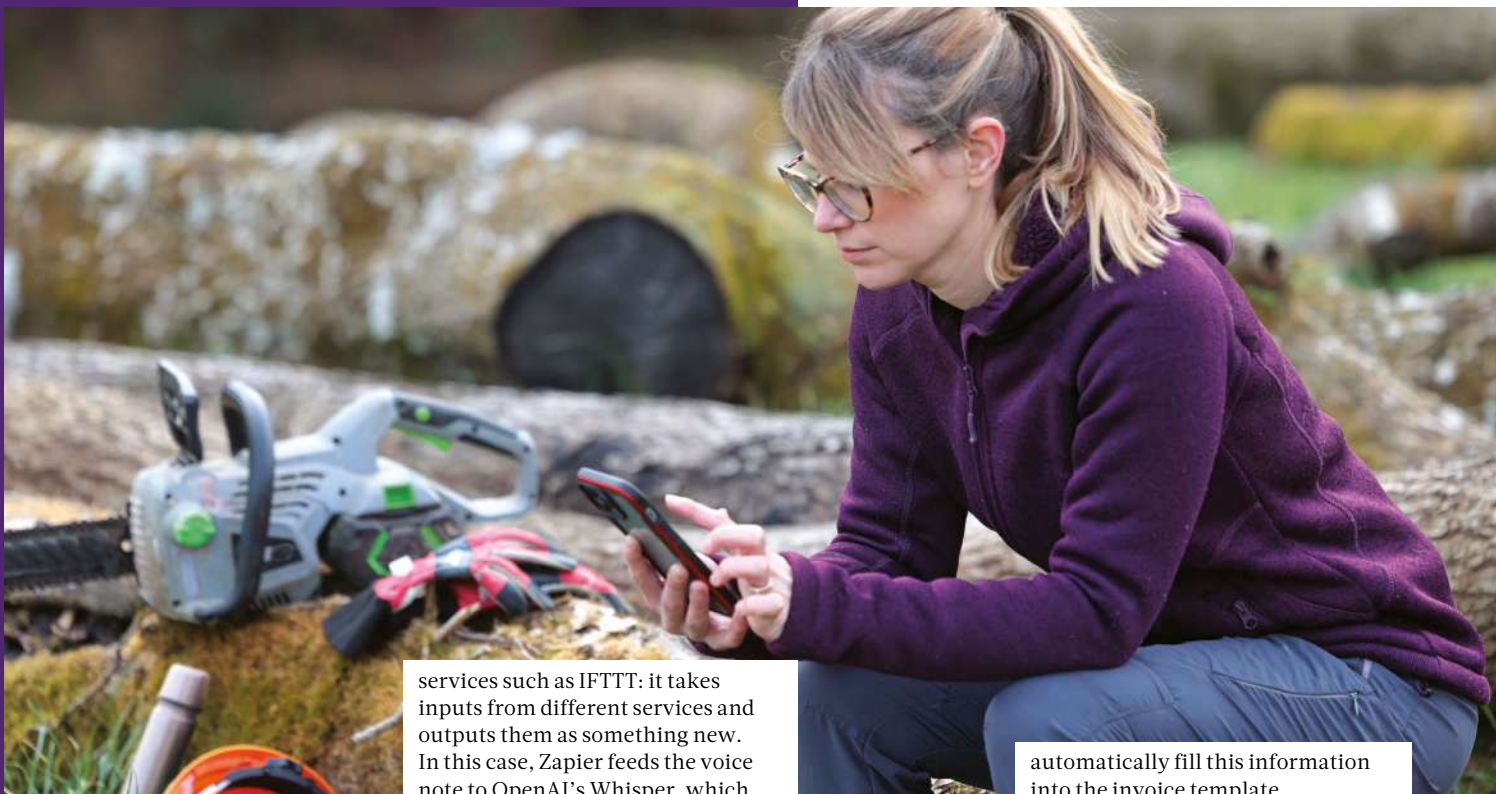
"We're a managed services provider," said O'Brien. "Our service delivery managers are doing interesting things, like they are exporting from our ticketing system the last quarter of incidents and requests, and giving it to Copilot to ask for key findings and recommendations."

ABOVE Customer support services are using AI to answer queries

That involves exporting data from the ticketing system and feeding it into an office document that Copilot can understand. But the firm has also deployed a private ChatGPT instance trained on the company's knowledge base to help support staff answer technical queries. "We've indexed 97,000 documents and it's pulling answers specific to Advania, almost as if it was known by GPT," said O'Brien.

Even for general support queries, the AI is replacing the tried-and-trusted Google search for answers. "We've got service desk engineers that have pretty much stopped using Google, because actually Copilot and the underlying LLM knows the answer," said O'Brien. "They're doing things like 'give me the script to close the port on this Cisco firewall', some operational thing that is quite esoteric and specific."

The AI is replacing the tried-and-trusted Google search for answers



SKILLED TRADES

Without wishing to descend into stereotypes, one of the reasons people take up a trade such as plumbing or carpentry is that they're not great at "paperwork". AI can certainly help tradespeople complete the mundane admin jobs they have to deal with, even when they're doing something else with their hands.

Just over a year ago, Nadia Richman gave up her career as an academic researcher to set up her own gardening company, Wee Beastie Gardens in Hertfordshire. Her business quickly took off, and one of her biggest problems was finding time to invoice customers, provide quotes for new projects and all the other little admin jobs that any small business owner will be familiar with.

Her husband, SEO expert Danny Richman, decided to lend a hand, cobbling together a variety of AI tools to ease the admin burden. Nadia's bespoke AI system allows her to send an invoice, send a quote to a potential customer or add a task to her to-do list simply by speaking the rough details into her phone. "She's halfway up a tree, lobbing some branches off, and she'll say [into her phone] 'send an invoice to Penny Smith for weeding her front garden and removing the tree stump from her drive. And I did that job last Tuesday and I'm going to charge her £672.50'." said Danny.

That voice note is then sent to an AI automation service called Zapier, which is an AI equivalent of

services such as IFTTT: it takes inputs from different services and outputs them as something new. In this case, Zapier feeds the voice note to OpenAI's Whisper, which is the company's voice-to-text model. Richman describes Whisper as "awesome".

"I downloaded a clip of this Glaswegian guy speaking on YouTube, telling a story in which I could not understand a single word that he said, and Whisper handled it perfectly," he said. Aside from strong accents, Whisper can also cope with background noise, such as chainsaws or a van engine, meaning Nadia doesn't have to repeat herself six times to be understood.

Zapier takes the audio recording, has it transcribed by Whisper, and it then forwards the text transcript to OpenAI's GPT API. The first thing that does is classify the transcript into one of three categories: to-do, invoice or quote. Each of these categories has a separate path created in Zapier, outlining what the AI should do for each.

For instance, if it determines that Nadia is creating an invoice, it will extract the relevant information from the GPT transcript, generate the invoice in Zoho Books, then send a confirmation that it's sent the invoice to Nadia's inbox. The AI is able to extract all the key details – the client, the job description, the amount, the invoice date – and

automatically fill this information into the invoice template.

ABOVE AI can help take the strain out of dealing with paperwork

If Nadia is providing a quote for a customer, the process is similar, with the AI using a quote form in Zoho Books and sending it to the customer. If it's a to-do item, it will create a card in Trello, where she can review her outstanding tasks when she's finished cutting back begonias.

The AI is accurate enough that Nadia doesn't need to manually review quotes or invoices before she sends them. "We tested it for a while to make sure it wasn't messing up, and one thing we found is she needs to make sure that she's not being ambiguous when she makes the recording," said Danny.

"So, for example, one of the things we found is sometimes she would say, 'I'll go and see Barry and speak to him about his oak tree'. And sometimes it misclassified it as a quote rather than as a to-do task. So now she knows that when she's using it, she just says at the beginning of the recording 'add to my to-do list, blah blah blah', or 'send a quote to Barry, blah blah blah.'"

Danny posted the workflow on social media and there was huge interest in it from a range of professions. "There's a lot of people in trade who are out and about all day," he said. "This is just one example of having a little thing on

your phone where you can just make a recording and then take actions based on that recording. It could be applied to so many different areas."

Nadia's AI system allows her to send an invoice or a quote by speaking into her phone

AI doesn't only allow for a greater volume of research to be conducted; it's more accurate, too



MARKET RESEARCH

Qualitative research such as focus groups can be enormously helpful for companies testing out new products or services, helping them to find out what customers really think before they unleash something on to the market. But collating the feedback from such research isn't easy. It often requires hours of poring over recordings or transcripts, and there's always the risk that the people doing the analysis are listening for what they want to hear, not what the customer actually said.

AI is helping to cut through the grunt work of qualitative research, according to Seamus McCauley, head of public affairs at Holiday Extras, and delivering more reliable results. McCauley cites the example

of sending out a survey to hundreds of customers, in which you might include a free text box to let them tell you what they think of a particular product without being constrained to pre-determined answers or blunt ratings out of ten. Before AI, "analysing the free text was so horribly laborious, nobody bothered," he said.

Now, however, "it will give you a very good summary of what the 20,000 words that have come back is. And from there, you've got a much better view of the market."

This is one of AI's core strengths, so-called sentiment analysis, where it can make a determination of whether a customer is satisfied, disappointed, frustrated or whatever in a tiny fraction of the time it would take a human analyst to wade through all those responses and make a determination.

ABOVE Collating information from focus groups is a key AI strength

ChatGPT is allowing companies to do the type of research that would have been prohibitively expensive and time consuming before. He cites the example of focus groups, where you might interview people one-on-one or in a small group. "AI is enormously helpful with that because, historically, you do that in a room, you have to write it down and get somebody else to write it down. You'd have one guy behind a one-way mirror watching. You'd have one person transcribing and recording it, and then afterwards you'd have to work out what was said, plus a moderator.

"I can now do it single-handedly because me on the end of a video call, plus an AI transcription bot, just running the transcript through a summary machine at the end, means I can do ten video interviews over the course of a day. At the end of it, I run the whole thing through [the AI] and say, 'what did I hear?' and the AI will almost invariably get it spot on."

AI doesn't only allow for a greater volume of qualitative research to be conducted; it's more accurate, too. "If I'm doing the talking and the note-taking, I'll write down bits that sound interesting and, inevitably, the bits that sound interesting are the bits that confirm my biases," said McCauley. "Whereas if the AI writes down everything, especially from ten people over the course of a day... you've got an objective view of what's been said."

That doesn't mean it's entirely bias-free. "It has a different set of biases implicit in however it was taught or the models it was taught on. But it doesn't happen to have my arbitrary biases - it's got a collective average of human biases, which is as good it's going to get."

MARKETING

One look at your inbox is all you need to confirm that a vast amount of marketing is done via email these days. AI's copywriting abilities make it easier – and cheaper – than ever before to target customers with mail shots.

Ross Jenkins is the CEO of email marketing agency DigitalME. The arrival of ChatGPT has broadened the range of services he can offer to clients. “An e-commerce shop came to us two days ago and said ‘we’re coming up to Black Friday. We want to have an email series, one email a day. Can you get them built?’”

Jenkins said he gave the client the option of creating the emails, including text and graphics, with AI or with a human creator. They replied: “Whatever’s cheapest.”

If cost is the driving factor, “AI’s always going to win” according to Jenkins, although that doesn’t mean the emails are completely devoid of the human touch. “We build it with AI, show the client a draft, then we go back and we edit it and make changes just to make it more personal, because AI just isn’t all there,” said Jenkins.

Email marketing is very much a numbers game. It’s possible to see the open rates and how many people click on links on every email you send, among other metrics. Jenkins claims he’s “not seeing much difference” when it comes to the open or clickthrough rates of emails generated by AI and those created by humans.

The big difference is volume. “People will come to us and say, ‘I want do an email a day or an email every other day’, whereas before for \$500 every email, they might not want to do 30 emails over the course of a month, because it’s obviously going to drain the bank. Now, with AI, they’re like, ‘go ahead, do whatever you can’.”

While a big increase in email marketing might not fill the average customer with joy, Jenkins believes the big opportunity for AI will come from being able to target messaging much more accurately to the individual consumer, because AI can generate thousands of personalised versions of the same campaign. “AI in the future will be amazing for segmentation,” he said. “I think you’ll be able to segment beyond your wildest dreams, and that’s where I think AI will become massive in terms of email marketing.”

PROMPT LIKE A PRO

If you’re using AI tools such as ChatGPT for work, there are ways to increase the quality of results you’re getting back. Here’s how to prompt like a pro – and avoid mistakes that could cost you your job.

Tell the AI what you’re doing

If you want to avoid the generic, bland mush that AI is more than capable of producing, you’ve got to give it tight instructions on how you want it to behave. For example, if you’re a restaurant owner using AI to write emails to confirm bookings, you might want to adopt a more informal, personal tone than a lawyer writing to a client. So state your business up front. For example: “We’re a friendly, family-run Italian restaurant. Write a short email to Mr Hanson confirming his booking for 4 people on 12 June at 7.30pm.”

If you’re using ChatGPT, you can create a GPT dedicated to this specific task, so you don’t need to keep re-entering the first sentence every time you want a new email drafted.

Set an example

Been sent an email marketing campaign that you felt had great impact? Seen a logo design that you would like to adopt for your own business? Tell the AI the kind of thing you’re looking for and it will normally deliver. In ChatGPT, you can do this by clicking the attachment button and uploading the text or image that you would like it to take inspiration from. For example, we uploaded the logo of Hastings United Football Club (*below right*) and asked it to “create a logo of a wolf in this style”.

If you’re asking ChatGPT to create a spreadsheet of data, you might tell it what you want as the headers for each row and

column to ensure consistent formatting with what your company ordinarily produces, or even upload a previous example.

Train it on your data

You get the best business results with AI when it’s trained on your data, not relying on a generic knowledge base. To give an example from *PC Pro*’s sphere, we could upload a spreadsheet of all the benchmark results we’ve recorded for laptops we’ve reviewed over the years. Then when the next laptop comes in for review and we enter its scores into the AI, we can ask it for a summary of how it compares to, say, all laptops costing between £1,000 and £1,500 that have been reviewed in the past year.

Apply AI to your existing tools

There’s a tendency to think AI is a siloed application, only available through, say, the ChatGPT website or its app. However, services such as Zapier can be used to bring AI to the services or apps that you already use for your business. Let’s say, for example, your business has a Google Sheet for new sales leads that’s automatically populated every time someone fills out a form on your website. You can use a Zapier “Zap” to have a message sent to a Slack channel every time a new row is added to that spreadsheet, ensuring someone chases that lead as soon as it lands. You might even add a GPT layer in between that summarises the sales lead and gives it a rating, so you can prioritise the most promising leads. That’s just one of a million different examples of how Zapier can interact with the software you already use.

Don’t share sensitive data

We’ve shared examples here – such as lawyers using AI to examine contracts or teachers using AI to check student reports – where sensitive data is being shared. But in these instances, the AI was used in carefully controlled environments where sensitive data was adequately protected. Such guarantees don’t exist on free ChatGPT accounts or Claude or Microsoft Copilot in Bing. Don’t share sensitive data unless you’re 100% sure of the data controls, and always check your company’s policy on using AI services before doing so for work. Otherwise AI really could cost you your job. ●



You’ve got to give it tight instructions on how you want it to behave



“Ticks all the boxes”



“Fantastic quality”



“Outstanding combination!”



“The **best** printer”



“A cut **above**”



“Reliable and trouble free”



So much *love*, so little fuss.

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functioning without fuss.

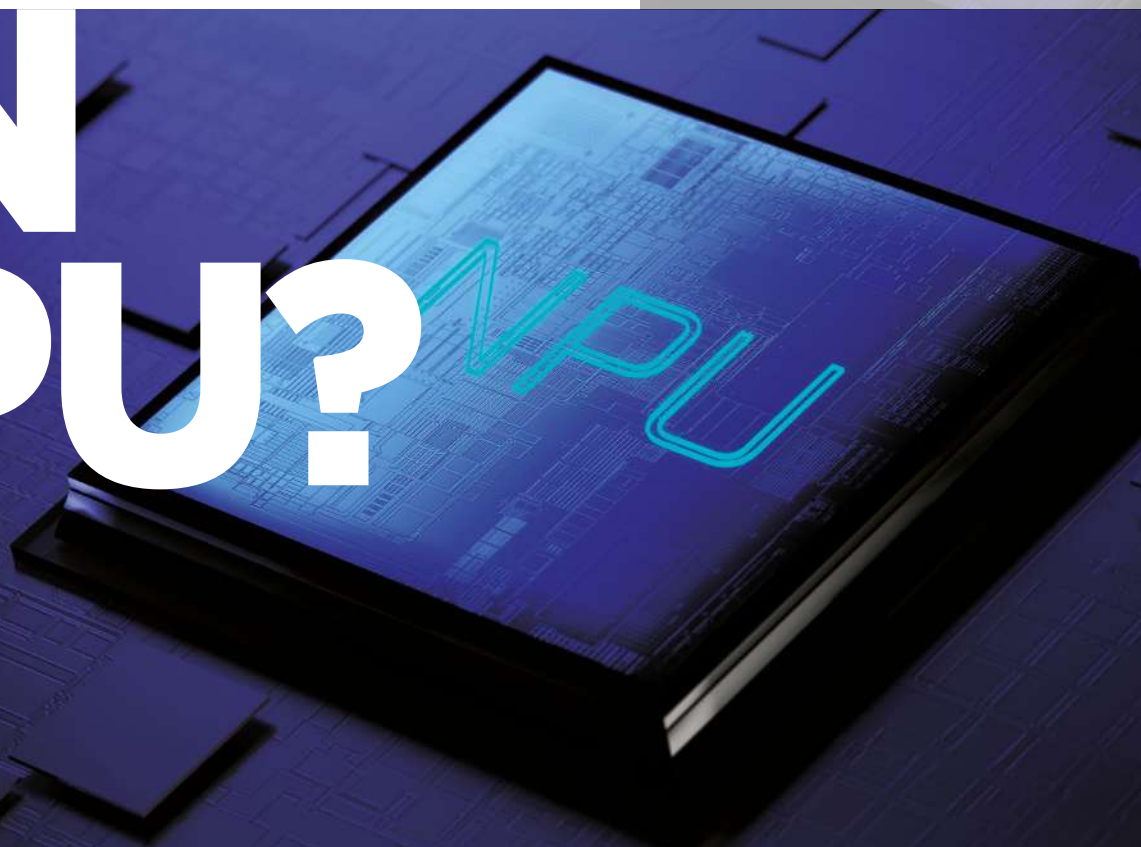
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WHAT IS AN NPU?

The latest specialist chips put AI at your fingertips. **Darien Graham-Smith** finds out what's new in neural processing



We're all familiar with the CPU and the GPU – they sit at the heart of almost every PC made in the past 40 years (albeit the GPU has sometimes been built into the CPU). Lately, though, they've been joined by a new friend: the neural processing unit, or NPU.

NPUs aren't a brand-new idea. The first implementations appeared, with little fanfare, in mobile chipsets in 2017. But in the past few years, as AI workloads have exploded onto the scene, they've become more and more important. Today it could be reasonably argued that the rise of this new type of processor is the most significant development in systems architecture in 50 years.

The reason is that, while the NPU is simpler and more specialised than either the CPU or GPU, it opens up a whole new dimension of computing capabilities, enabling the sort of complex on-device AI processing that a regular CPU would struggle with.

This doesn't mean you can run a complete ChatGPT or Midjourney engine on your personal laptop. But it does mean that almost any application can now take advantage of the sort of AI processing functions that power those platforms – and it provides a standard hardware model for growing and improving these capabilities in the future. When you next buy any sort of consumer electronic device, from a high-end laptop to a smart TV or a home security gadget, there's a good chance it will include an NPU.

What does an NPU do?

NPUs are designed specifically for AI operations, which in practice means working with data structures called tensors. Entire books have been written about exactly what tensors are and what can be done with them, but the simple way to think about a tensor is as a matrix of values that can have any number of dimensions.

While that may seem like quite an abstract concept, it happens to neatly mirror the way the neurons in our brains connect together to store and process information – hence the description of these processors as “neural”. Rather than stepping sequentially through a big list of operations, as a CPU might, our brains and NPUs both work on large sets of information all at once, identifying relationships between values and applying previously learnt connections to generate new outputs.

To be clear, NPUs aren’t the only type of silicon capable of tensor operations. This sort of highly parallel workload is also a good fit for GPU architectures, and the distinction between NPU and GPU products can be hazy. Some major AI services, such as ChatGPT, are powered by Nvidia’s H100 cards, which are effectively GPUs optimised for tensor operations, while Google’s Gemini AI runs on a combination of custom-designed NPUs (which Google calls TPUs, for “tensor processing units”) and Nvidia cards.

Many laptops – including Microsoft’s Copilot+ PCs – now feature a chip with a discrete NPU, separate from the GPU. And pretty much all high-end phones do, too. This allows a tight focus on carrying out tensor operations as quickly and efficiently as possible, without having to build in additional graphics functions. It also provides

a clean route to increasing AI power in future designs, without incurring the cost and energy consumption of scaling up the entire GPU.

Getting to the bottom of TOPS

It goes without saying that the NPU in your phone or laptop isn’t as powerful as the data centres that run ChatGPT or Google Gemini. But how powerful is it? As a rough indication of how much AI power a given device has, the industry has settled on a

It could be argued that the rise of this new type of processor is the most significant development in systems architecture in 50 years

measurement called TOPS, short for trillion operations per second.

If you’ve been involved in computing for a while you may be rightly dubious of this sort of metric – it calls to mind the old “MIPS” measure of CPU performance (million instructions per second), which was largely meaningless for comparing processors with different architectures.

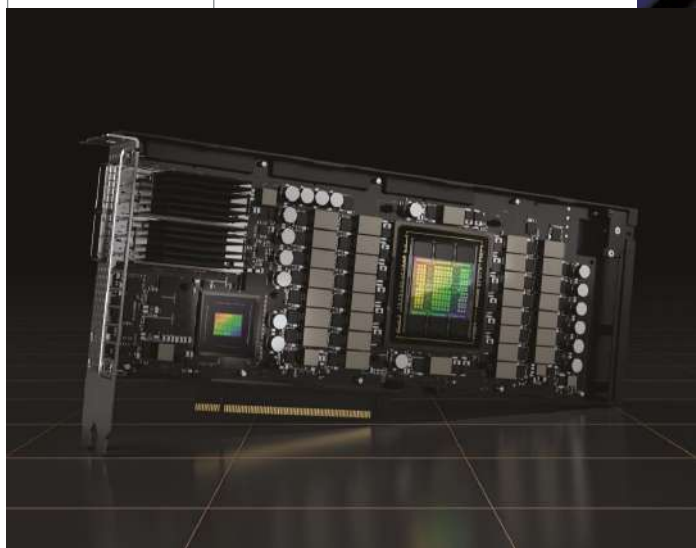
TOPS is a bit more useful, however. Because an NPU will normally only be tasked with a few specific types of calculation, we don’t need to worry so much about differing implementations. It’s true that the overall system design could have an impact on, for example – the speed at which the NPU can be fed with data to process. And even in the most efficient systems, a TOPS rating won’t necessarily translate directly to real-world performance, as not all AI tasks will push the NPU up to

100% utilisation. *Ceteris paribus*, however, a TOPS rating provides a reasonable yardstick for comparing the capabilities of different NPU models and designs.

It’s worth bearing in mind that there’s no magic number of TOPS. Given enough time and enough RAM, any NPU should be able to complete any AI task. The real question is whether performance is acceptable, which is a rather subjective measure. To bring some clarity to the situation, Microsoft recently drew a line in the sand, declaring in May that its new “Copilot+ PC” badge would only be granted to Windows laptops containing NPUs offering more than 40 TOPS of AI power.

What platforms have NPUs?

The prize for the first mass-market NPU goes to Apple. Back in 2017 the company introduced its “Neural Engine” as part of the A11 chipset, as used in the iPhone 8 and X. With a performance rating of 0.6



ABOVE The mighty Nvidia H100 card drives the world’s most powerful AI services

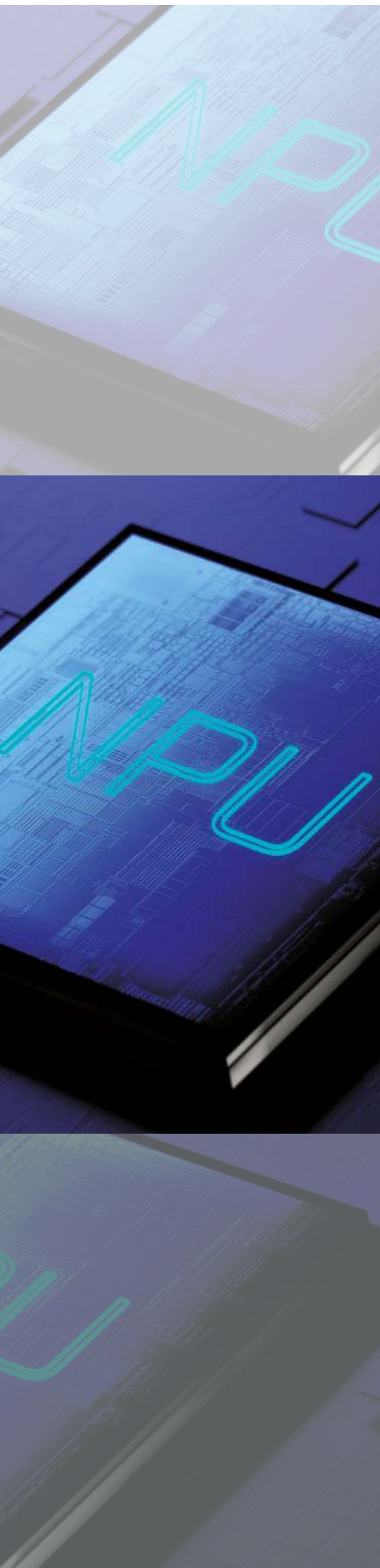
TOPS this was hardly a powerful chip, but it got rapidly faster with each subsequent revision, and by 2020 the NPUs used in Apple’s A14 and M1 chips were claiming 11 TOPS – an 18-fold increase in just three years. Today the Neural Engine in the latest M4 processors can manage up to 38 TOPS.

Android phones, meanwhile, have been gaining AI capabilities of their own, courtesy largely of Qualcomm’s Hexagon NPU. This was first built into the Snapdragon 845 chipset, released in 2018, and offered 3 TOPS of AI power; since then, as with Apple, the NPU has seen huge performance gains, with the latest top-end Snapdragon 8 Gen 3 SoC claiming 29 TOPS for mobile devices.

While mobile platforms have made great strides in neural computing,

LEFT Microsoft has decreed 40 TOPS to be the minimum for Copilot+ PCs





traditional laptops have been slower off the mark. Almost all of the first wave of Microsoft Copilot+ PCs have been powered not by AMD or Intel, but by Qualcomm's Arm-based Snapdragon X Elite chipset, which offers 45 TOPS of AI power alongside snappy desktop performance.

But if the x86 giants were caught napping, they're now making up for lost time. AMD's mobile "Hawk Point" Ryzen 8000-series processors, launched at the end of last year, include an NPU rated at up to 16 TOPS, while the new Ryzen AI 9 HX 365 and HX 370 laptop chips boast 50 TOPS of NPU power.

The chipset also leans on the CPU and GPU for extra AI help, adding up to a claimed total of 80 TOPS for the entire system – always presuming that you're not using the hardware for anything else at the time.

Intel's offering has been similar. The mobile Meteor Lake platform, launched at the end of 2023, was the first to use the company's new Core Ultra branding, and also the first Intel chip to include a dedicated NPU. While this neural processor is rated at only 11 TOPS, Intel calculates that the integrated GPU provides an additional 18 TOPS of processing power, with the CPU adding a further 5 TOPS.

As we cover in our separate article on Intel's Core Ultra 200V platform (see p46), codenamed Lunar Lake, Intel's new chips have massively boosted AI speeds with around 100 TOPS in total (the exact amount depends on the chip) and from 40 to 48 TOPS in the NPU.

Across all platforms, it's striking how quickly NPU capabilities are growing, with the sort of generation-on-generation performance gains that CPU and GPU designers can only dream of. By the end of the year there should be no shortage of x86-powered systems powerful enough to qualify for Microsoft's Copilot+ branding – and by the time Christmas 2025 rolls around, the 40 TOPS requirement will probably seem laughably low.

Cloud vs local AI

If you've recently bought a Copilot+ PC, you may be feeling pretty good about its onboard AI capabilities – but don't get too smug, as there's a huge gulf between consumer NPUs and professional-grade AI

hardware. A single Nvidia H100 card, as used by ChatGPT and other cloud-based AI services, can deliver 3,026 TOPS over a PCI Express slot, or 3,958 TOPS using the server-specific SXM interface.

And if you were thinking about investing in one of these cards to turbo-charge your own PC, be ready for a severe case of sticker shock: H100 cards typically change hands for around £20,000 per unit.

Even if you did save up and treat yourself to an H100, you'd still be

It's striking how quickly NPU capabilities are growing, with the sort of generation-on-generation performance gains that CPU and GPU designers can only dream of

some way off matching the capabilities of the big AI services. Elon Musk recently boasted that his xAI company was running off a cluster of 100,000 H100 cards, while Microsoft reportedly uses 150,000 cards to power its Azure AI offerings and other services. Most impressively, Meta's AI hardware portfolio combines Nvidia silicon with in-house designs to achieve a claimed equivalent to 600,000 H100 cards, or about 2.4 billion TOPS.

When there's such a vast gulf in capabilities between online services and on-device AI processors, you might wonder why we even bother with local NPUs. But there are good reasons, one being latency. While a remote cluster might be many millions of times more powerful than your phone or laptop, it takes time to send an AI request over the internet and receive a response. By contrast, local processing can be effectively instantaneous – which makes a big difference to the user

BELOW Google's Gemini Nano engine is compact enough to run on your phone



experience in tasks such as voice recognition or photo editing. It also enables appliances such as smart TVs and security cameras to carry out real-time AI upscaling or audio enhancement that wouldn't be viable over an internet connection.

Then there's cost. If you want to create high-quality AI images then you'll need to hand over a monthly wedge of cash to Adobe, Midjourney (see p72) or Leonardo (see p73). If you can produce such images on your PC for free, you could save a lot of money over the course of a year.

The other big advantage of on-device AI is privacy. In the early days of ChatGPT (which is to say, last year) Samsung famously banned all employees from using the service, after it emerged that employees were

– how can a personal device offer a useful AI experience when it has only a tiny fraction of the power of the mainstream cloud services?

Again, the answer comes in a few parts. First, the really demanding part of AI is the training. This is the process of analysing a corpus of existing data – typically text, images or audio files – and building up the tensor mappings that enable the computer to “make sense” of input and generate valid output.

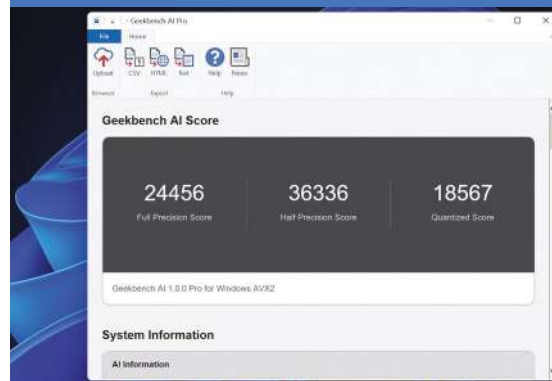
Training a powerful AI system such as ChatGPT or DALL-E involves terabytes of data (including, controversially, works of cultural relevance that may be protected by copyright) and, as you can imagine, the process of identifying and inferring connections between the

How many TOPS do I have?

If you're eager to try out local AI, you might be wondering just what your own devices are capable of. There are a few AI-focused benchmarks available, but one of the most versatile and user-friendly is the brand-new Geekbench AI test. Launched just last month, it can be downloaded for Windows, macOS and Linux from [geekbench.com/ai](https://www.geekbench.com/ai), with Android and iOS versions available in the respective app stores.

Geekbench AI performs a series of tasks that test the AI performance of your CPU, GPU and NPU. The benchmark takes just a few minutes to run on most devices, and when it's finished you can compare your score to other users' systems in the Geekbench database, to get a clear all-round view of your AI-readiness.

The one thing that Geekbench AI can't give you is a TOPS score for your system. That's because TOPS ratings reflect 100% silicon utilisation, whereas real AI workloads have more of an ebb and flow. For this very reason, though, TOPS isn't something you need to worry about – despite what Microsoft might have you believe.

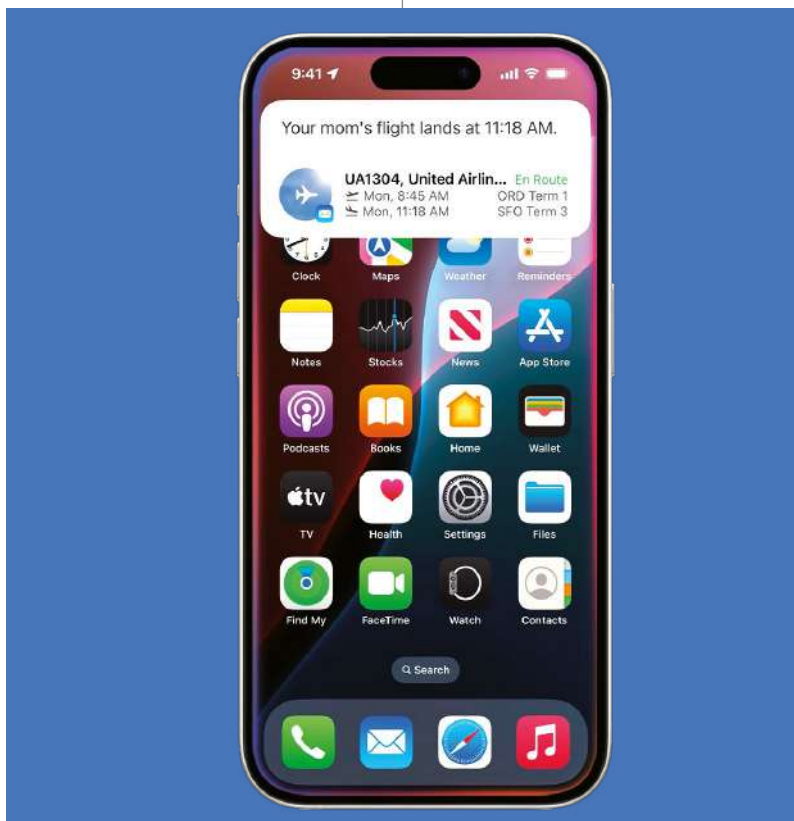


LEFT Apple's AI services use the NPU to ensure personal data is processed locally

GPT-4o mini engine, while Android's on-device AI uses a slimmed-down version of Google's platform called Gemini Nano. Both engines are technically much simpler than their parent models, but still work perfectly well for common tasks.

Even when you make an AI request that your device can't handle on its own, the NPU can help by breaking down your input as far as possible, before passing the data upstream to a cloud service for processing. This might not be any faster than going directly to the cloud, but the service provider will be grateful for anything that reduces the load on its very expensive AI hardware.

On-device preprocessing also allows for personal information to be stripped out of the query that's sent to the servers, so you can get the benefit of full-power AI without having to worry about your private data being transmitted over the internet – a big selling-point of Apple's new Apple Intelligence services. If you're concerned about this, though, it's always worth digging into the specifics of whatever AI functions you're using, as the “black box” nature of AI means it's often unclear what's being carried out locally and what's being sent up to the data centre. ●



“leaking” commercially sensitive information in their queries. ChatGPT's terms of use allowed OpenAI to store the data indefinitely, and even to use it for further training – raising the possibility that the chatbot could at some point start regurgitating the trade secrets that it had learnt.

On-device AI helps address such concerns. If your private queries and conversations can be handled locally, there's no need to transmit them to a server somewhere, and much less danger of a leak.

Who got the power?

All of this is very well, you might say, but one big question remains

words and phrases across such a vast body of information is tremendously compute-intensive. Once the model has been created, it takes far less power to feed input into it, and get responses out.

This isn't to say that a full implementation of ChatGPT or Google Gemini could run on your phone. But it gets close enough that AI operators can create cut-down versions of their models that do run on personal devices, by methods including judiciously reducing the mathematical precision of the original model (quantisation) and removing data and connections that aren't likely to be needed (pruning). In the above cases, OpenAI offers the



INSTANT EXPERT

MICROSOFT CLIPCHAMP



Windows' built-in movie-making app includes powerful tools for making high-quality videos. **Nik Rawlinson** gets close to the edit

Clipchamp is one of the great unsung features of Windows. It's a powerful modern video-editing app, which you can use to edit and assemble your video clips into professional-looking productions.

If you've previously used the old (now discontinued) Windows Movie Maker app, you'll be amazed at how much smarter Clipchamp is. It's not an upgrade but a completely different product, originally developed by an Australian company of the same name, and it's been in development for more than a decade. Since Microsoft acquired the publisher in 2021, Clipchamp has become the company's official video-editing platform, described as "an AI-powered video editor with everything you'll need".

Is Clipchamp free?

Clipchamp comes preinstalled with Windows 11, and can be downloaded to Windows 10 from the Microsoft Store. It will work on any version of the operating system released after March 2019, with a recommended minimum of 8GB of RAM.

The standard installation of Clipchamp lets you import and edit your own clips, access a library of stock audio, image and video materials, apply a range of filters and effects, and export your productions at 1080p resolution. All of that's completely free, with no time limitations, watermarks or other restrictions.

If you have a subscription to a Microsoft 365 plan for either Home or Business you can access additional premium features, which include an expanded selection of audio, image and video stock material, extra filters and effects, automatic content backup and 4K exports. Premium users can also create a "brand kit", to keep elements and styles consistent across multiple video projects.

If you don't have Microsoft 365 you can also upgrade to Clipchamp Premium from inside the app. However, this costs £9.99 per month or £99.99 annually, so it's actually cheaper to take out a full Microsoft 365 Personal subscription – you can consider the extra Office apps and 1TB of OneDrive storage as a bonus.

Clipchamp is also available as a free app for iPhone, which you can download from the iOS App Store, and there's an online edition for in-browser editing at app.clipchamp.com.

Top five features

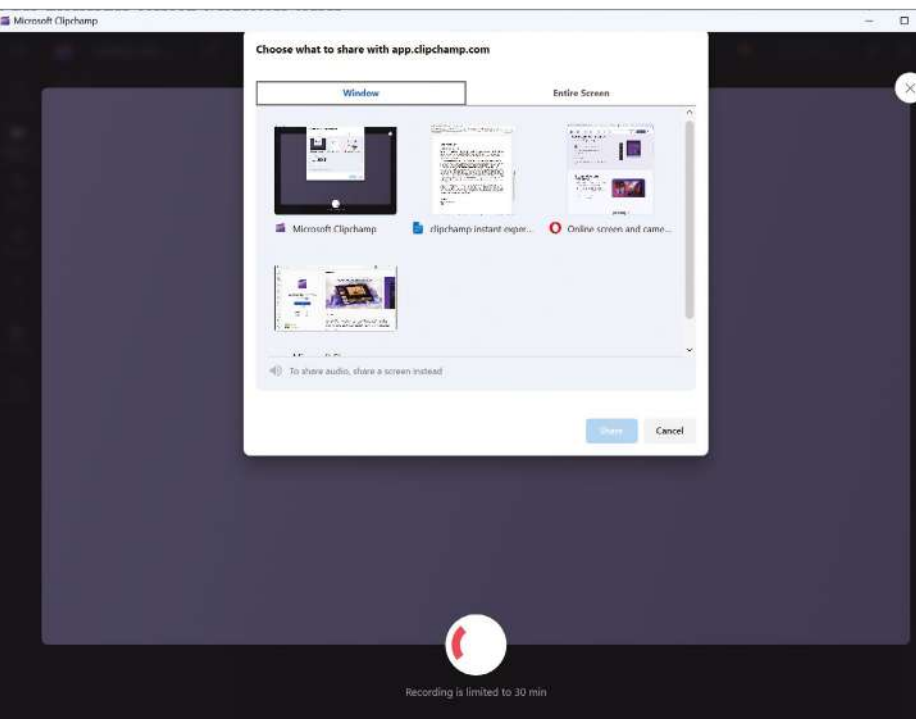
Clipchamp features a familiar timeline interface, allowing you to drag clips into order, trim their starts and ends and apply effects and crossfades. It also includes powerful workflow tools to help you create impactful videos, and work more quickly and efficiently. Here are five of our favourites.

1 Record your screen

Screen recording is an essential tool for tech tutors and online educators, allowing them to demonstrate a series of onscreen steps in a visual, instantly understandable way. It's also great for capturing and sharing gameplay videos.

Clipchamp makes it easy to record either your whole screen or a single window. To get started, click "Create a new video"; when the video-editing window appears, click "Record & create" in the sidebar. If you have a webcam, you can record the screen and your own face simultaneously (by clicking "Screen and camera") to add a personal commentary. If you don't have a camera, or don't want to use one, just click Screen.

Now select the application you want to record, or click across to the Entire Screen tab if you want to record the complete display. Click the red Record button when you're ready to start the video. When you've finished, hover over the Clipchamp window and a Stop button will appear. Click it and Clipchamp will play back your video for you to review. If you're happy with what you see, click "Save and edit"; otherwise, click "Retake recording" and try again.



THERE ARE NO TIME LIMITATIONS, WATERMARKS OR OTHER RESTRICTIONS

It's worth noting that audio recording isn't available in single-window mode; if you want to capture sound as well, you'll need to capture the whole screen. If that doesn't suit your needs, you can work around this limitation by zooming in on a full-screen clip to focus on the area you're interested in (see below).

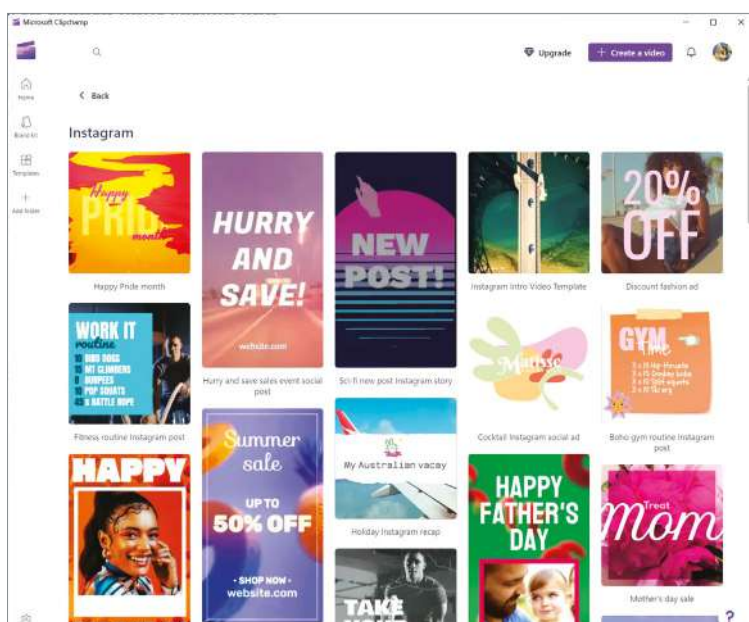
For full-screen capture, remember to organise your apps appropriately, so the relevant items are fully visible and distractions are kept to a minimum. If focusing on a single application window, resize it to minimise wasted space.

And remember that viewers may be watching in a small video window or on a phone screen, so consider scaling up your display. To do this, press Windows+i to open the Settings app, then click System, followed by Display. Use the Scale menu in the "Scale & layout" section to increase the level of zoom. Windows will instantly refresh the display, resizing interface elements such as menus and window borders as appropriate.

2 Optimise footage for different uses

When recording individual applications, there's a good chance your captured window won't perfectly match the shape of your video frame. The result will be black borders either to the left and right or above and below the video, which can be distracting and don't make best use of the space – again, particularly if viewers are using a phone to play back your footage.

You can resize your source material by clicking on it and dragging the



handles on the corners of the asset itself, but this will zoom into the footage proportionally without changing its overall shape, resulting in content getting cut off at the sides.

It's better to resize the container than the contents. To do this, click the "16:9" button above the video window and select an alternative shape that best suits either your footage or your intended playback device. If you're targeting smartphones held upright, for example, click "9:16", while "1:1" is a good choice for social networks that default to square image and video frames.

Making this change only half solves the problem, however: the empty black areas will be retained, making

TOP LEFT You can record your whole screen or a single application window

ABOVE Clipchamp includes templates for different video destinations

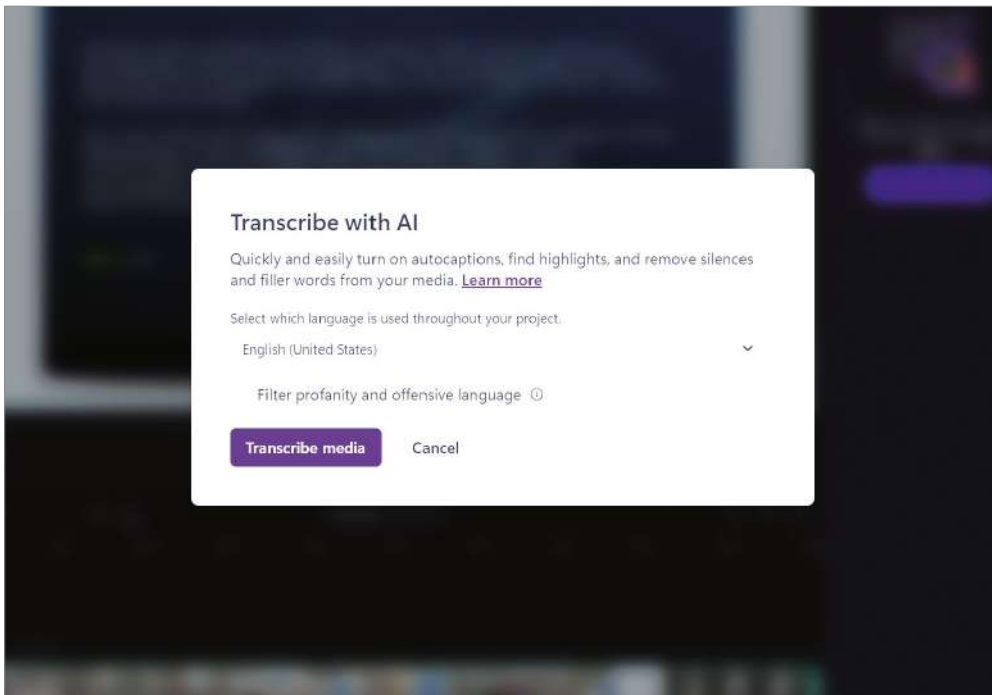
your video window even smaller. Now, however, you can click in the video itself to bring up a pair of resize buttons above it; click the Crop button on the left, and Clipchamp will automatically zoom in on the selected element to fit, without losing any of the edges beyond the window borders.

If you're making a video from existing assets rather than recording your screen (which you can do using the purple "Import media" button), you can save yourself a lot of

trouble by using an appropriate stage size from the start. Simply click the "16:9" button before importing your media, or use one of Microsoft's templates for YouTube, Instagram and so on. You'll find these on the Clipchamp home screen.

3 Automatic captions

Text captions are a worthwhile addition to almost any video. They're invaluable to deaf and hard-of-hearing viewers, and they also make it easy for viewers to browse your video in a social media feed where audio is disabled by default, or in situations where it's not appropriate to turn up the volume. Publishing a transcript of



your video also makes it much more searchable, so your content is more likely to be found by search engines.

The catch is that transcribing an entire script can be a tedious chore – but fortunately it’s not one you need to bother with, as the free edition of Clipchamp includes a powerful AI-assisted voice-recognition feature that can analyse your audio and automatically generate captions.

To use it, start by dragging your media onto the timeline. Then, click the Captions button in the right-hand sidebar; Clipchamp will ask which language your video features, so select the correct language from the drop-down menu and optionally tick the box to filter out profanities. Clipchamp will then quickly generate a complete transcript, and automatically overlay the captions

onto the video in time with the original spoken content. In the sidebar you can browse through the generated captions, and optionally download them as an SRT subtitle file that can be imported into other video-editing applications.

If you want to edit a caption, simply double-click it in the video window; this will bring up a text cursor, allowing you to make whatever adjustments you require. The formatting sidebar will also appear, allowing you to change the typeface, text size, alignment and so on.

4 Make things snappier

As a rule, the best online videos are short and to the point – so get into the habit of trimming out

ABOVE There's a handy automatic transcription feature

ABOVE RIGHT You can edit and format captions however you like



superfluous footage wherever you can and you’re more likely to keep your audience watching to the very end.

Clipchamp can help by using AI to automatically identifying pauses and retakes in your footage; it can even spot unnecessary filler words that can be removed. To use this feature, start by importing the footage that you want to work with and assembling it on the timeline, then click the “AI suggestions” button immediately above the timeline (it looks like two pinched diamonds) and click “Auto cut”.

If you haven’t previously created a transcription for the video you’re working on, Clipchamp will need to do this first – so, as with tip 3, select the language you’re working with, optionally filter profanities, then click Transcribe. Once the transcript has been produced, Clipchamp works its way through the assembled video looking for possible edits, and presents them as a series of suggestions through which you can click forwards and backwards.

Clipchamp doesn’t always get it right. In our example footage (see the screenshot above right), it’s identified a 37.4 second period that doesn’t include any spoken words. However, as this portion covers the launch of a rocket – the very subject of our video – we’ll click Ignore to discount the suggestion.

5 Create your own green-screen effects

Green-screen is a classic video trick that’s used to – for example – show images behind a newsreader, or place actors in front of computer-generated scenes. And with

CLIPCHAMP'S AI TOOLS

Clipchamp includes several other AI-powered features that can help you create high-quality videos – and they’re all included in the free edition of the software.

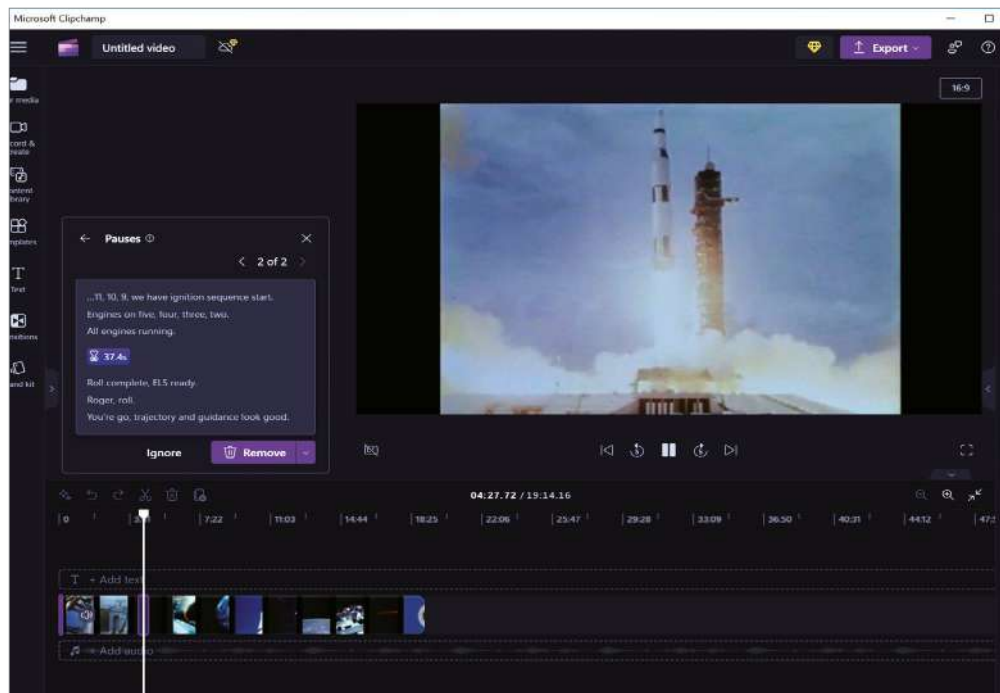
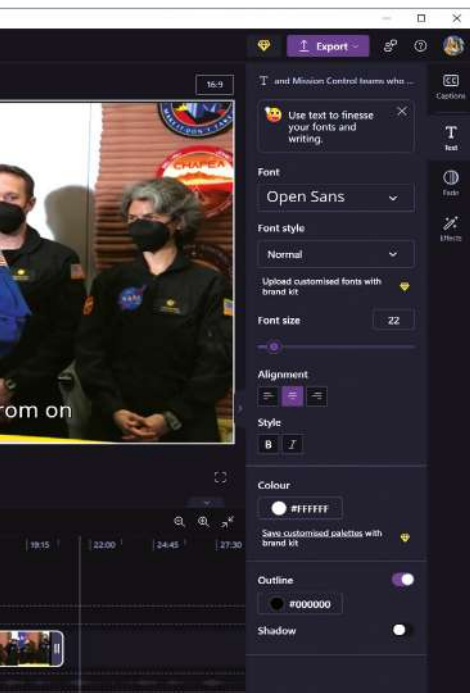
AI VIDEO COMPOSITION Clipchamp's Auto Compose feature can automatically assemble your photos and videos into a short video; all you need to do is pick the style of video you want to produce. Microsoft suggests using it, among other things, to create social media content in just a few clicks. Get started with the auto compose tool by clicking “Create a video with AI” on the Clipchamp home screen.

AUTOMATIC VOICEOVER Don't like the sound of your own voice? Delegate your voiceover to Clipchamp. It supports more than 80 languages, including English, Spanish, German, Greek and Japanese, with more than 400 voices available across the

various languages. Voiceovers are limited to 10 minutes each, but you can generate multiple voiceovers if needed to fill out your complete video.

SPEAKER COACH If you prefer to record your own voiceover, Clipchamp can help you speak more authoritatively. The integrated Speaker Coach gives you real-time feedback when you're talking to camera, highlights useless filler words that will reduce your impact, and checks the pitch and pace of your talking.

BACKGROUND REMOVAL We're all familiar with videoconferencing tools that can replace your drab office walls with exotic scenery. Clipchamp's background removal tool can work the same magic for your movies, isolating the subject of your video so you can virtually insert them into a different surrounding. The tool can also create a translucent watermark, which you can use to brand your content more or less discreetly – by either placing it neatly a corner, or emblazoning it across the middle of the screen.



Clipchamp you can use it to create your own composite scenes.

In fact, Clipchamp isn't limited to green; you can insert a video source into any solid green, blue or red area. There's even a selection of suitable stock video files included in the integrated media library, including several available to free users. To find them, click "Content library" in the far left sidebar, then search for "green screen", confining the results to just video material.

To apply the effect, first drag your green-screen footage onto the timeline, click on its track and click Effects in the right-hand sidebar. Select Green Screen – or, if your source material has a red or blue area rather than green, select the appropriate option from the "Screen colour" drop-down menu.

Now add a second track directly below it containing the video that you want to show within the solid colour area. Make sure this lower track of video is selected so you can see the handles on the corner of the footage in the playback window (even though you might not see the footage itself), and drag the handles to make your selected video fill the green area on the overlying video. As you can see in our image below, the timeline shows the upper track with its green area clearly visibly, while the main preview window shows the composited effect.

Taking things further

You don't need to pay for Clipchamp to take advantage of some of its impressively powerful effects. Even if you do want to take things further, you don't necessarily need to pay for a

ABOVE Clipchamp automatically identifies pauses, repetitions and filler words

premium subscription; you could export your footage and continue working with it in a separate editor, such as the free, professional-grade DaVinci Resolve, available from blackmagicdesign.com.

To export your video from Clipchamp for use in third-party products, click the Export button at the top of the editing window. Clipchamp will apply any necessary processing, then save it as an MP4 file. This is a widely used and broadly compatible format that most other video-editing platforms will be able to work with. You could even import it back into Clipchamp at a later date (for example, if you've created a picture-in-picture effect using the green screen filter and want to further embed that within another green-screen scene). ●

BELOW Green-screen effects let you insert one piece of footage into another

YOU DON'T NEED TO PAY TO TAKE ADVANTAGE OF SOME OF ITS EFFECTS





BEST OF IFA 2024

Contributors: Tim Danton, with contributions from Steve Clark, Timothy Coleman, Jason England, James Frew, Hamish Hector and Josephine Watson



Europe's biggest consumer technology show celebrated its 100th anniversary this year, but more importantly it produced a bunch of products we're now desperate to review. Here are our picks

All prices include VAT unless stated

LAPTOPS

Acer Swift 16 AI (Intel)

PRICE From €1,299 from [acer.co.uk](https://www.acer.co.uk)

AVAILABILITY December 2024

Three out of the four Acer Swift AI laptops announced at IFA featured 14in panels, but it was the 16in version that stood out for us. The spec sheet says it's 1.5kg, but it feels light in the hand and the grey aluminium alloy chassis looks far more stylish than it should. We played with the OLED version, but the IPS panel shares its 2,800 x 1,800 resolution. And, with Intel's new chips inside – up to the Core Ultra 9 288V – it's packed with power.



Acer Travelmate P6 14 AI

PRICE From €1,349 exc VAT from [acer.co.uk](https://www.acer.co.uk)

AVAILABILITY January 2025

We're suckers for sub-1kg business laptops, so the new Travelmate P6 14 AI had us at "carbon fibre chassis". The range starts with a Core Ultra 5 226V processor and so ticks Microsoft's Copilot+ PC for business boxes, and that's not the only plus point: think cutting-edge connectivity such as Wi-Fi 7, a bright IPS display (either 1,920 x 1,200 or 2,880 x 1,800) and all the ports you need. The keyboard has plenty of travel despite the slender chassis, and while the ThinkPad X1 Carbon below still wins for its cushioned action, there's no hiding from the Travelmate's price.

Honor MagicBook Art 14 Snapdragon

PRICE To be confirmed

AVAILABILITY Late 2024

Honor announced that its new MagicBook Art 14 would ship with first-gen Core Ultra chips and a Snapdragon version at IFA, and it's the latter that



earns a Best of IFA 2024 award. It will pack an Elite X1 chip to handle on-PC AI tasks with ease – so long as they require an NPU – whilst hopefully giving battery life close to 20 hours. And this sleek, stylish, sub-1kg laptop has one last trick: the webcam is detachable, sliding into a slot on the left-hand side when you don't need it. Perfect for privacy lovers.

Lenovo ThinkPad X1 Carbon Gen 13 Aero Edition

PRICE From €2,699 exc VAT from [lenovo.com](https://www.lenovo.com)

AVAILABILITY November 2024

For such a ridiculously compact and lightweight laptop, the X1 Carbon has an oddly long name. This particular incarnation is the love child of Intel and Lenovo, who spent many long nights together these





past two years to create AI-enhanced "Aura Edition" software that takes advantage of the Core Ultra 200V chip within. This will provide the ability to tap a phone – Android or iPhone – against the side of the screen and connect it, with your phone's photo gallery immediately appearing. Drag and drop to your heart's content. Expect a full day's working life, even with the 14in OLED screen shining bright.



Lenovo Yoga Slim 7i Gen 9 Aura Edition

PRICE From £1,300 from [lenovo.com](#)
AVAILABILITY Now

Is it possible to release too many laptops at once? Lenovo certainly came close at IFA, with seven additions to its consumer lines alone. The 15.3in Yoga Slim 7i Aura Edition sits at the top of that tree, featuring the same Aura software as the ThinkPad above but adding Lenovo's Creator Zone software, which allows people to use the new Core Ultra chip's AI power to create images based on text prompts. Much like DALL-E or Midjourney, but on your PC. And it produces decent results, too. Weighing 1.5kg and measuring as thin as 13.9mm, the Yoga is a typical high-end Lenovo laptop with a 120Hz IPS panel.



Samsung Galaxy Book5 Pro 360

PRICE From £1,699 from [samsung.com](#)
AVAILABILITY Now

Good luck telling the new Book5 Pro 360 apart from its Book4 predecessor, but that isn't a negative: the fact that it's just as thin and light is fine by us. The gorgeous AMOLED touch display remains, providing vivid images when watching videos and allowing you to use this 1.7kg 2-in-1 as a giant Windows 11 tablet to sketch, take notes or read a digital comic. If its Lunar Lake CPU lives up to the company's promise of a 25-hour-long battery life, it may soon find itself on the A List.

Lenovo Auto Twist

The Lenovo Auto Twist concept is, essentially, a face-tracking, Windows 11 2-in-1 with a motorised hinge. And one that responds to simple commands, such as "open



Intel "Lunar Lake" Core Ultra 200V

Could Lunar Lake be the fillip that Intel needs to help it through this roughest of years? We think it just might be. The reason, as we explain in our full review on p46, is that it's very nearly a match for Qualcomm Snapdragon chips in terms of efficiency while beating it out of the park for gaming – and with no worries about compatibility. But what really should give Intel cheer is that laptop manufacturers are so behind it, with dozens of new models announced at IFA 2024 based around the Core Ultra 200V series (formerly Lunar Lake).



the lid". Although it's a proof of concept, this device is more accurately named than other Lenovo

devices here, as its 13.3in display does indeed twist, rotate and tilt automatically. During our demo, Auto Twist captured a panoramic photo of attendees, but you might also use it during video calls to track you as you pace around. You might be asking yourself, "but why?", but there was a genuine gasp during the demo. Could this be the future?



PHONES & TABLETS



PC PRO
★ BEST OF IFA 2024 ★

Honor Magic V3

PRICE £1,700 from [honor.com](#)
AVAILABILITY Now

Here's the TL;DR version of our review of the Honor Magic V3 on p62, which made its debut at IFA 2024: stunningly slim, gorgeous photos, bags of power. Sure, the huge camera mount dominates its rear, but this surprisingly sturdy foldable phone is so slender that you forget it's a foldable until it's time to take advantage of that 7.9in inner screen.

TCL 50 Pro Nxtpaper 5G

PRICE £280 from [argos.co.uk](#)
AVAILABILITY Now

We hope to have a full review of this Android 14 phone next month, but from our time with it in

the IFA halls we can tell you the TCL 50 Pro delivers on its main promise: the phenomenal matte screen that's a joy to read in its default colour mode, but that you can switch to a focus mode via a simple button. This cuts out interruptions, but also transforms the screen to mono. It sounds like a gimmick, but if you suffer from phone addiction then this looks to be a brilliant and affordable buy.



PC PRO
★ BEST OF IFA 2024 ★

TCL Nxtpaper 14

PRICE £400 from [argos.co.uk](#)
AVAILABILITY Now

Size isn't quite everything, but if you're looking for a big-screen tablet then direct your eyes towards

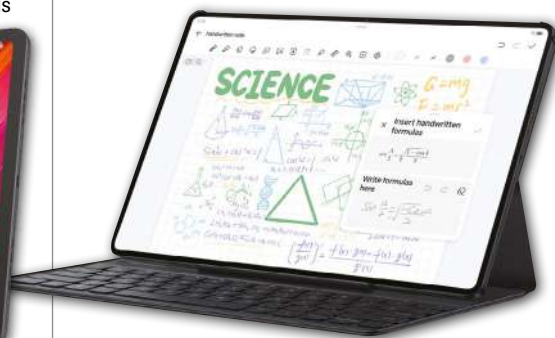


the Nxtpaper 14. As the name gives away, this includes a 14in version of TCL's superb paper-like panel, with the "Ink paper" mode particularly good if you need to read long documents. It isn't the fastest, with a mid-range Helio G99 chip in place, but you do get Android 14, 256GB of storage and a surprisingly respectable set of speakers considering this tablet's price.

Honor MagicPad 2

PRICE £500 from [honor.com](#)
AVAILABILITY Now

Honor can't match the reach of Apple's tablet ecosystem, particularly its rich selection of apps, but if you're after a productivity-focused tablet then the MagicPad 2 is a great choice. The Snapdragon 8s Gen 3 chipset offers plenty of speed, but it's the striking 12.3in OLED panel and 5.8mm-thin design that amazes for the price. When you consider that you also get a pleasant keyboard and stylus for £500, it's a stunning buy. And this tablet plays even nicer with Honor phones and laptops, acting as a second screen and making it easy to share files, while Honor's AI Defocus Display promises great things for those with myopia.



GAMING

Acer Project Dual Play

What happens when one of the best gaming laptops and a Nintendo Switch get busy in the bedroom? It's a question we never thought needed answering, but in doing so Acer has created arguably the stand-out concept of IFA 2024. Simply push a button towards the top of the laptop, and the touchpad pops up and disconnects from the base. Turn it over and you'll discover a fully featured controller, so gamers aren't limited to a keyboard and mouse when on the go. And because those controllers are magnetically connected, you can pull them apart à la Switch and get your fill of split-screen fun.



CONCEPT



Acer Nitro Blaze 7

PRICE To be confirmed
AVAILABILITY Early 2025

Acer gave a handful of IFA visitors a chance to play with the Nitro Blaze 7 at its invite-only stand, and most liked what they saw. It feels more comfortable in the hand than the MSI Claw, with a better curvature to the back for a proper hand grip, while the Ryzen 7 8840HS promises even higher frame rates than Intel's Core Ultra 7 258V. But, as with the MSI, you have to wonder if this will stand up to the incoming Ryzen Z2 models in early 2025 given the fact that this includes more advanced AI capabilities that can run the next generation of FSR frame generation.

MSI Claw 8 AI+

PRICE To be confirmed
AVAILABILITY Early 2025

MSI only announced its Claw 8 in March, but the response to this 8in handheld gaming device was, shall we say, underwhelming. MSI is hoping that this update, with the second generation Intel Core Ultra chips inside, will answer the criticisms around both performance and gaming – and frankly they should. The challenge for MSI is that by the time it's released in early 2025 the competition will have caught up, including from rivals powered by AMD's Z2 Extreme – which AMD confirmed was on course for release in early 2025 during IFA 2024.



HEALTH & FITNESS

RingConn Gen 2

PRICE \$299 from ringconn.com
AVAILABILITY Now



After a successful Kickstarter launch, the RingConn Gen 2 smart ring made its first public appearance at IFA 2024, and even at \$299 (\$90 higher than its Kickstarter price) it promises many advantages over rivals such as the Samsung

Galaxy Ring – perhaps top of those being that there's no subscription fee. You'll enjoy up to 12 days of battery life, depending on the size of your ring, "90.7%" accurate sleep apnea tracking, and integration with Apple Health and Google Fit.

Amazfit T-Rex 3

PRICE £279 from uk.amazfit.com
AVAILABILITY Now



The Amazfit T-Rex 3 runs on Zepp OS 4, which includes the GPT-powered Zepp Flow – ask it a question about your workout data and good things should happen. But its exterior is all about the great outdoors, with large stainless steel bezels, a bright display and four easy-to-whack physical buttons. It also has dual-band GPS support for precise location tracking, a Readiness Score (similar to the Training Score you find on the best Garmin watches), and the battery can last up to 27 days.

Withings ScanWatch Nova Brilliant Edition

PRICE £550 from withings.com
AVAILABILITY November 2024

Who said smartwatches couldn't be beautiful? The Withings ScanWatch Nova Brilliant not only looks great, with a sleek shape, titanium bezel, durable sapphire glass and either a silver or gold finish, it's packed with a whole host of health features. These include the Cardio Check-Up tool, an in-app service that offers a clinical review of your heart health from board-certified cardiologists within 24 hours – all without you needing to leave your home.



ODDS & ENDS



PC PRO
★ BEST OF IFA 2024 ★

Keychron K2 HE

PRICE \$130 from keychron.com
AVAILABILITY October 2024

One smaller hall within IFA was almost totally taken by mechanical keyboard manufacturers, many of which were pushing magnetic switches. These make it even easier to adjust the actuation point of each key and should last longer than conventional switches. Keychron's new K2 HE set stood out thanks to its design and keen price. Not a bargain, perhaps, but this heavyweight (in every way) keyboard features a stylish wooden finish that will look great for years. And it's available with black or white keys.

Timekettle W4 Pro Interpreter Earbuds

PRICE \$449 from timekettle.co
AVAILABILITY Now

Timekettle launched its W4 Pro earbuds at IFA 2024, with two in the charging box. Looking like a pair of early-2000s Bluetooth earpieces, both units have a soft, rubbery feel where it rests on the ear, with a hardened plastic mouthpiece. Speak, and your words are translated into the target language in two to three seconds – either via a softly spoken human-sounding voice in your ear or on a phone app. While we'd like translation to be faster still, it's a potential deal-maker for businesses in foreign climes.



PC PRO
★ BEST OF IFA 2024 ★



DJI Neo

PRICE £169 from store.dji.com
AVAILABILITY Now

This tiny 135g drone can take off from the palm of your hand to shoot stabilised 4K videos, complete with AI subject tracking, or 12MP photos. It's incredibly easy to go from drone novice to creating stunning aerial videos, even if you stick to the basics and pair it with your phone using DJI's Fly app. Or you can pay £299 for its Fly More Combo, which adds two batteries and a handy remote controller. FPV goggles cost a hefty £579. Once airborne, the Neo sticks close to you via six automated flight moves (Boomerang, Helix, Circle, Rocket, Dronie and Spotlight), and the only downside is its real-world battery life of around 15 minutes.

LG Self-Driving AI Home

This isn't the first small, rolling smart home robot we've seen – remember Amazon Astro? – but it has the most personality, and is the first one that actually made us go "Oh, maybe that's worth getting". For a start, it's so expressive – not only does it have great animated eyes, but when it's responding or talking to



CONCEPT

you, it can wobble with enthusiasm. With ChatGPT-4o powering its ability to understand and respond, this feels like a step beyond what came before. It also self-navigates around your home and acts as a smart home hub, and while it can't make a cup of tea it can read your kids a bedtime story.

Plaud NotePin

PRICE \$169 from plaud.ai
AVAILABILITY Now (limited)

PC Pro podcast listeners will already be familiar with the Plaud NotePin, a device that can hang on a pendant, sit on a wristband or clip onto a shirt. The idea is that it's always with you, so if you have a thought or need to record a meeting then you can press a button and it will capture your voice notes – and then transcribe them via the cloud. And it doesn't sting you with a costly subscription, with the bundled Starter Edition including 300 minutes of use. Our live listeners on Discord weren't impressed, but we're keeping an open mind until we test it. ●



Bluetooth 6

The Bluetooth Special Interest Group (SIG) made Bluetooth 6 official at IFA 2024, with a whole bunch of promised improvements. Top of the list is Channel Sounding. Supported devices can identify the distance between them to a centimetre, making "find my device" services hugely accurate and hopefully making smart locks work better, too. There are a bunch of other improvements as well, most around efficiency and reliability, so we look forward to Bluetooth 6 landing on devices soon.



Reviews

The biggest, best, most exciting products in technology – reviewed and rated

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Asus Zenbook S14 OLED with Intel Core Ultra 200V

A storming debut for Intel's Core Ultra 200V processor, even if you never knowingly use local AI



SCORE ★★★★★

PRICE 32GB, £1,458 (£1,750 inc VAT)
from scan.co.uk

To say Lunar Lake, the codename for Intel's second-generation Core Ultra processors, is a big deal for Intel understates things in the same way that winning the presidency is a big deal for Donald Trump. For the first time since its foundation in the 1960s, Intel is under existential pressure: its historically low share price means other companies could consider hostile bids; its bold but expensive plan to set up its own foundries in the USA is floundering; and Qualcomm's partnership with Microsoft to create the first Copilot+ PCs had seen its rival racing off into the distance while Intel was left at the starting line, still lacing up its shoes.

But write Intel off at your peril. It faces stiffer competition than ever, through the AMD-Nvidia axis in the data centre and AMD-Qualcomm in PCs, but this is a company with an unmatched heritage for CPU design. And that heritage shows in the Intel Core Ultra 200V chips.

These processors are designed with a purpose: to deliver performance-per-watt that's exactly right for thin and light laptops. Unlike AMD with its

Ryzen AI 300 series chips (see issue 361, p48), Intel isn't looking to come out top in all benchmarks here; instead, it wants to deliver battery life that rivals Snapdragon chips and snappy all-round performance that brings a smile to the lips of laptop users.

Power moves

That meant big decisions, the first of which is to drop Hyper-Threading. We're so used to seeing this in Intel's CPUs that it almost sounds like heresy – who doesn't like two threads for the price of one? – but Intel's designers worked out they could deliver more performance-per-watt by focusing on single-thread efficiency in its all-new Lion Cove P-cores. This doesn't mean Intel is turning its back on Hyper-Threading – it still makes sense in

ABOVE Asus' Zenbook S14 is the perfect showcase for Intel's impressive new chips

chips where power efficiency isn't the priority – but it is a major change.

Intel has also simplified the product line. Every Core Ultra 200V chip includes eight cores, four of which are powerful P-cores and four efficient E-cores. As before, P-cores will take on key tasks and workloads while background tasks are swept up by the E-cores. Intel claims that it has massively increased the performance of these cores, which is another reason it has deprioritised Hyper-Threading.

All this – together with numerous more subtle tweaks, including the integration of system memory onto the package in the same style as Qualcomm and Apple – means Intel claims it delivers 2.29x performance per watt versus the Core Ultra 7 165H. And it makes bolder claims still: that,

Intel Core Ultra 200V Series

	CORES	INTEL SMART CACHE	P-CORE MAX BOOST	E-CORE MAX BOOST	GRAPHICS CHIP	GRAPHICS PEAK	GPU TOPS	NPU TOPS	OVERALL TOPS
Ultra 5 226V	8 (4P, 4E)	8MB	4.5GHz	3.5GHz	Arc 130V	1.85GHz	53	40	97
Ultra 5 228V	8 (4P, 4E)	8MB	4.5GHz	3.5GHz	Arc 130V	1.85GHz	53	40	97
Ultra 5 236V	8 (4P, 4E)	8MB	4.7GHz	3.5GHz	Arc 130V	1.85GHz	53	40	97
Ultra 5 238V	8 (4P, 4E)	8MB	4.7GHz	3.5GHz	Arc 130V	1.85GHz	53	40	97
Ultra 7 256V	8 (4P, 4E)	12MB	4.8GHz	3.7GHz	Arc 140V	1.95GHz	64	47	115
Ultra 7 258V	8 (4P, 4E)	12MB	4.8GHz	3.7GHz	Arc 140V	1.95GHz	64	47	115
Ultra 7 266V	8 (4P, 4E)	12MB	5GHz	3.7GHz	Arc 140V	2GHz	66	48	119
Ultra 7 268V	8 (4P, 4E)	12MB	5GHz	3.7GHz	Arc 140V	2GHz	66	48	118
Ultra 9 288V	8 (4P, 4E)	12MB	5.1GHz	3.7GHz	Arc 140V	2.05GHz	67	48	120

Note: the overall amount of TOPS includes 4-5 from the CPU.

using the same chassis and parts (other than the motherboard), it saw almost two more hours of life in the UL Procyon Office Productivity battery life benchmark than a system using Qualcomm's X1E-80-100 chip.

All-round compatibility

Intel is especially confident when it comes to gaming performance. It claims the new Arc Xe2 is the world's best built-in GPU, despite the relentless focus on power efficiency. Comparing the Core Ultra 9 288V to the Core Ultra 7 155H across over 45 games, it claimed the new chip was 31% faster at 1080p Medium settings, and 16% quicker than a laptop with an AMD HX 370 inside. Comparison against Qualcomm is tougher as it still struggles in games – it's the single biggest reason not to buy a laptop with a Snapdragon inside – but Intel claimed a 68% margin of victory against the top-end X1E-84-100. Once you add in support for ray tracing, Direct X 12 Ultimate and the promise of up to 67 TOPS (many AI tasks are better suited to GPUs than NPUs), it's hard not to be impressed.

This brings us to local AI. For the first time, Intel chips meet the 40 TOPS threshold that Microsoft set for its Copilot+ PCs, so you can buy a laptop with a Core Ultra 200V inside with confidence that it will run Cocreator AI drawing, creative video filters and real-time translation – or at least, it will once a Windows Update drops in November. As our table shows, the exact power of the NPU depends on which processor you choose, but Intel is keen to point out that its support for int8 and FP16 models gives it a compatibility advantage over both AMD and Qualcomm for now.

And, as it uses an x86 rather than Arm architecture, Intel doesn't have to worry about compatibility when it comes to Windows apps. Reassuring for IT departments who don't have to worry if their custom software will run smoothly on Qualcomm hardware using the (generally excellent) Prism translation layer. It's also true that consumers may have old software that refuses to run. However, Qualcomm deserves huge praise for its relentless focus on this area, so outside of games I don't see compatibility as a deal-breaker.

There are connectivity promises Intel says you'll enjoy with any laptop with Core Ultra 200V inside. The first is Wi-Fi 7, though only 5GHz support is guaranteed; 6GHz delivers lower latency and faster speeds, so that's a big omission. Then comes Thunderbolt 4, along with compatibility for USB 4, but if you were hoping for Thunderbolt 5 then we can only apologise. Likewise Bluetooth 6, but at least Bluetooth 5.4 is guaranteed.

CINEBENCH 2023 (SINGLE CORE)

Asus Zenbook S 14 Core 9 Ultra 9 288V, 32GB	1,927
Asus Zenbook S 16 Ryzen AI9 HX 370, 32GB	1,913
Asus Zenbook S 13 OLED Core i7-1355U, 16GB	1,829
Asus Zenbook 14 OLED Core Ultra 7 155H, 16GB	1,688
Asus Vivobook S 15 Qualcomm X1E-78-100, 16GB	1,119
Asus Vivobook S 15 Qualcomm X1P-42-100, 16GB	1,104

HIGHER IS BETTER

3DMARK TIME SPY

Asus Zenbook S 14 Core 9 Ultra 9 288V, 32GB	4,470
Asus Zenbook 14 OLED Core Ultra 7 155H, 16GB	3,607
Asus Zenbook S 16 Ryzen AI9 HX 370, 32GB	3,469
Asus Vivobook S 15 Qualcomm X1E-78-100, 16GB	1,899
Asus Zenbook S 13 OLED Core i7-1355U, 16GB	1,789
Asus Vivobook S 15 Qualcomm X1P-42-100, 16GB	982

HIGHER IS BETTER

BATTERY LIFE (LIGHT USE)

Asus Zenbook S 14 Core 9 Ultra 9 288V, 32GB	19hrs 6mins
Asus Vivobook S 15 Qualcomm X1P-42-100, 16GB	15hrs 47mins
Asus Vivobook S 15 Qualcomm X1E-78-100, 16GB	12hrs 49mins
Asus Zenbook S 13 OLED Core i7-1355U, 16GB	12hrs 20mins
Asus Zenbook 14 OLED Core Ultra 7 155H, 16GB	12hrs 21mins
Asus Zenbook S 16 Ryzen AI9 HX 370, 32GB	12hrs 16mins

HIGHER IS BETTER

CINEBENCH 2023 (MULTICORE)

Asus Zenbook S 16 Ryzen AI9 HX 370, 32GB	14,462
Asus Vivobook S 15 Qualcomm X1E-78-100, 16GB	12,051
Asus Zenbook 14 OLED Core Ultra 7 155H, 16GB	11,155
Asus Zenbook S 14 Core 9 Ultra 9 288V, 32GB	9,938
Asus Vivobook S 15 Qualcomm X1P-42-100, 16GB	8,185
Asus Zenbook S 13 OLED Core i7-1355U, 16GB	7,538

HIGHER IS BETTER

SHADOW OF THE TOMBRAIDER (1080P, HIGH)

Asus Zenbook S 16 Ryzen AI9 HX 370, 32GB	37
Asus Zenbook S 14 Core 9 Ultra 9 288V, 32GB	36
Asus Zenbook 14 OLED Core Ultra 7 155H, 16GB	33
Asus Zenbook S 13 OLED Core i7-1355U, 16GB	20
Asus Vivobook S 15 Qualcomm X1P-42-100, 16GB	14
Asus Vivobook S 15 Qualcomm X1E-78-100, 16GB	Did not complete

HIGHER IS BETTER

BATTERY LIFE (VIDEO RUNDOWN)

Asus Zenbook S 14 Core 9 Ultra 9 288V, 32GB	17hrs 12mins
Asus Zenbook 14 OLED Core Ultra 7 155H, 16GB	13hrs 46mins
Asus Zenbook S 16 Ryzen AI9 HX 370, 32GB	13hrs 24mins
Asus Zenbook S 13 OLED Core i7-1355U, 16GB	12hrs 9mins
Asus Vivobook S 15 Qualcomm X1E-78-100, 16GB	Did not complete
Asus Vivobook S 15 Qualcomm X1P-42-100, 16GB	Did not complete

HIGHER IS BETTER

Intel continues to push its Evo Edition branding, too. The idea here is that Intel works in partnership with laptop manufacturers so that Evo-badged laptops meet a minimum set of desirable criteria. Most of these are inherent to the 200V chips, such as NPU enhancements and 5GHz Wi-Fi 7, but others include EPEAT Gold support, "real-world battery life" and a promise around being quiet and cool. It's all a little hazy, which is perhaps one reason why Evo branding hasn't set the world alight.

Asus advantage

So that's the theory (if you want more technical detail, read Paul Alcorn's excellent article on our sister site Tom's Hardware at [tinyurl.com/362lunarlake](https://www.tomshardware.com/362lunarlake)). To see it in practice, Asus sent me its Zenbook S 14 with a Core Ultra 9 288V inside. And you can see how it performed compared to thin-and-light rivals in the graphs above.

The Zenbook S 14 makes a lot of sense as a showcase for the Ultra 200V series. For one, it's the epitome of a thin and light laptop: at 12.9mm thick, airflow space is at a premium. Still, Asus finds room for two fans and

reckons it can supply up to 28W of power to the chip without throttling. You'll hear the fans come on when it's pushed, but it's never annoying – and 99% of the time this laptop stayed

whisper-quiet.

Asus also finds room for a 72Wh battery. That's worth flagging in big print, because many 1.2kg laptops skimp on battery size. And the reward is quite staggering battery life:

19hrs 6mins in our light-use test and 17hrs 12mins for video playback. Both those results were with Wi-Fi on and the screen set at a pleasant 150cd/m², and for the first time ever I feel safe to say that even if you push this Intel laptop hard it will last a full working day – and beyond. We are finally moving into an era where power supplies can be kept at the desk. It's a compact 65W adapter, too, weighing 219g without the power lead.

Performance charts

So how fast exactly is Intel's new family? For now, I have limited data points: one laptop with a Core Ultra 9 288V chip and 32GB of RAM, which

"As it uses an x86 rather than Arm architecture, Intel doesn't have to worry about compatibility for native Windows apps"



ABOVE The Core Ultra 200V is particularly impressive in gaming

will naturally paint the 200V series in the best possible light. To make the comparisons as fair as possible, I've used Asus Vivobook and Zenbook laptops, all of which feature similar power setups and cooling systems, and all rely on integrated graphics.

For single-core and multicore tests, I've printed scores for Cinebench 2023 as I have data for all the laptops (Cinebench R24 is relatively new). Here, the new Intel chip takes a narrow lead for single-core speed but falls into the middle of the pack for multicore power. It was a similar story in Geekbench 6, with the Core Ultra 7 288V pushing this Zenbook to an excellent 2,859 in the single-core section but a decidedly average multicore score of 11,063. Both AMD and the Qualcomm X1 Elite chips beat it here, with 13,239 and 14,263 respectively.

The rule-of-thumb lesson to draw here is that Intel's Core Ultra 200V chips are right up there with the fastest processors for single-core power, but if your workloads involve many threads then look elsewhere. However, we're moving to a world where it's not merely workloads but specific software that matters. If your favourite apps offload key tasks to NPUs or GPUs, then you may still find that Intel's chip is a better choice.

Things are a fraction simpler when it comes to games. In the vast majority of cases, I expect Intel's Arc 140V graphics to produce fractionally faster performance than the Radeon chip built into AMD's Ryzen AI 9 HX family. Their respective 3DMark Time Spy scores show the difference in raw power. However, Intel's Core 5 Ultra family uses the lesser Arc 130V GPU, and I would expect that gap to narrow significantly. As already mentioned, Snapdragon laptops are not a great choice for gamers.

I tested both the new Zenbook S 14 and the AMD-powered Zenbook S 16 in a trio of real games too, and found little to choose between them. I'll settle on 1080p High settings for easy comparison. In *Shadow of the Tomb Raider*, the S 14 averaged 36fps to 37fps for the S 16. That switched in *Dirt 5*, with Intel's chip leading the way with 33fps versus 29fps. And in *Cyberpunk 2077*, it was neck and neck with both averaging 32fps (although that increased to 45fps when I switched on Intel's frame generation).

I don't want to draw too many conclusions about AI performance yet, as I've yet to find a great benchmark. But, for the record, the Core Ultra 9 288V returned a quantized score of 3,693 in Geekbench AI's ONNX framework compared to 4,231 for the Ryzen HX 370 and 5,025 for the Snapdragon.

Zen pluses

And what of the Zenbook S 14 itself? Let's just say that to see it is to want it. Much of this is due to the svelte, compact chassis, but the only negative I have to say about the Ceraluminum lid is that its name is awful. Asus describes it as a "high-tech ceramic material", and while I prefer the S 14 in its Zumaia Gray finish rather than Scandinavian White, it not only looks great but feels nice, almost weathered, to the touch.

The inside and bottom of the chassis are more understated, but as with all recent Zenbooks I was struck by the build quality. It's almost impervious to bends, and Asus has put it through a bunch of MIL-STD 810H tests. One of these is the shock test, where the Zenbook is dropped onto its corner, but it's still worth investigating the extended warranties as you only get a single year of cover as standard.

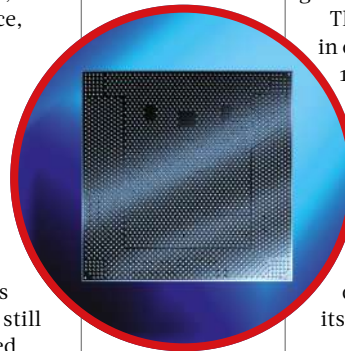
One drawback of Intel's new chips is that the memory is embedded onto the chip, so fingers crossed that it doesn't go wrong. Fight your way past ten Torx screws and all you can easily replace are the 1TB SSD – which returned 5,017MB/sec sequential reads and 3,538MB/sec writes in CrystalDiskMark 8 – and the battery.

Key thinking

Asus can sometimes go wild with its touchpad designs, but here it sticks to a relatively straightforward approach. There are hidden tricks – slide your finger along the left and right of the touchpad to adjust volume and brightness, or along the top to fast-forward/rewind when watching videos – but what's most important is that it's both smooth and large. I thoroughly enjoyed using it.

It would be nice if the company showered similar levels of love onto its keyboard, because there's nothing here to lift the Zenbook away from the masses. The keys are large and easy to hit, there's a respectable amount of travel, but it lacks the dampening of the best designs.

ABOVE Despite the slim proportions, the laptop boasts a full complement of ports



ABOVE The Core 200V series chips are Intel's best laptop processors ever

Where Asus has lavished both love and budget are the speakers. Music sounds excellent, but games and films are also brought to life. And this is where the OLED panel shows its strength, with such gorgeous, rich colours you might find it difficult to go back to a desktop monitor.

Those impressions were backed up in our tests, with the panel covering 100% of the DCI-P3 gamut, and even stretching well beyond that colour space (118%). It's a more impactful panel than the Vivobook S 15's (see p53), and while it wasn't quite as bright – peaking at 371cd/m² – it's still visibly obvious that this is a top-quality display. That's reflected in its average Delta E of 0.4.

Brilliant debut

It's always reassuring to see a full complement of ports on an ultraportable laptop such as this, and even though you only get one USB-A port (on the right) that should be enough. The left-hand side is home to two Thunderbolt 4/USB-C 4 ports, a 3.5mm jack and an HDMI 2.1 connector, so there are no obvious omissions. And, as with all Core Ultra 200V laptops, it comes with Wi-Fi 7 and Bluetooth 5.4.

All of which means I'm struggling to find anything to criticise about this laptop. Even its price is competitive at £1,750 (£1,500 for the Core Ultra 7 version). It's far from cheap, but this is a huge leap

in quality compared to the Vivobook S 15 at £1,000, and the best all-round laptop I've tested for this price.

Things are more nuanced for the Intel Core 200V series, but overall I think it deserves the status as Intel's best laptop chip ever. Yes, last year's H-series chips were faster in multicore tasks, but that step backwards is more than compensated for by its terrific single-core power, the improved GPU and (at last) an NPU that's sufficiently powerful to rub shoulders with Snapdragon chips. **TIM DANTON**

"I'm struggling to find anything to criticise about this laptop. Even its price is competitive. I highly recommend it"

BELOW The Zenbook S 14 is a well-built laptop that will stand the test of time



SPECIFICATIONS

8-core (4 P-cores, 4 E-cores) Intel Core Ultra 9 processor 288V • Intel Arc 140V graphics • 32GB LPDDR5X-8533 RAM • 14in 120Hz OLED touchscreen, 2,880 x 1,800 resolution • 1TB M.2 PCI-E Gen4 SSD • Wi-Fi 7 • Bluetooth 5.4 • 1080p IR webcam • HDMI 2.1 • 2 x Thunderbolt 4/USB-C 4 • USB-A 3.2 Gen 2 • 3.5mm combo jack • 72Wh battery • Windows 11 Home • 310 x 215 x 12.9mm (WDH) • 1.2kg • 1yr C&R warranty • part code, UX5406SA-PZ207W

How we test

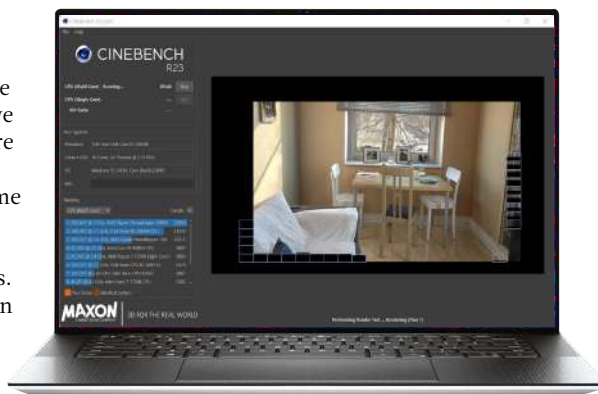
Laptops and PCs

We run a selection of benchmarks on all the PCs and laptops we test. Where possible, we use a cross-platform test so we can compare Windows and macOS machines, which is where both Geekbench and Cinebench come into play. Both push the CPU to its limit, exposing how well cooled a system is.

We run extra tests for Windows systems.

We use PCMark 10 to benchmark systems in office tasks, content creation and basic tasks such as web browsing and video calls. We also run 3DMark Time Spy and *Shadow of the Tomb Raider* as a minimum. We test laptops and PCs that include discrete graphics with a range of games, such as *Metro Exodus Enhanced* and *Dirt 5*.

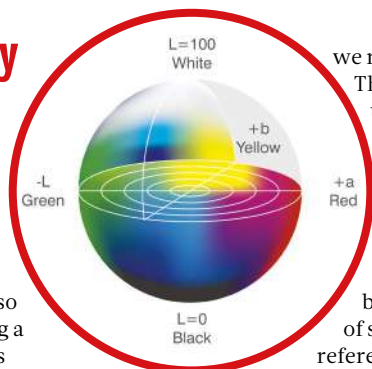
For laptops, we test battery life with Wi-Fi on and the screen brightness set to 150cd/m². We fully charge the laptops and drain them until they reach 5%. For Windows laptops, we will use a mix of PCMark 10's light-use and video-based tests, or a web surfing benchmark where a laptop automatically visits sites until the battery dies. We also use this test for MacBook.



ABOVE We put PCs and laptops through our intensive set of benchmarks

Screen quality

In each laptop, phone, tablet and monitor review, you'll see our conclusions about the screen quality. Some of this will be subjective, but we also test each screen using a X-Rite Display 11 Plus colorimeter. We measure maximum brightness, colour accuracy and (for monitors)



we run Geekbench 6. This is a good test of the processor and memory in particular, and include both a test for single-core and multicore performance. See below for a selection of scores to provide a reference of what's good... and what's not so good.

We also run 3DMark Wild Life test to give a measure of gaming performance.

We test tablet battery life by playing a full-screen video until the battery runs out with the device. To simplify the test, we use Airplane mode. We set the brightness to as close to 150cd/m² as we can get in the device's settings. We also put phones through a set of real-world and labs-based tests.

LEFT We use a Display 11 colorimeter to measure sRGB gamut coverage and Delta E

BELOW We play a video with the screen set to 150cd/m² to test battery life



consistency – there may be a difference in, say, brightness from the middle and the edges of the panel. We also measure Delta E, which is a guide to how accurately panels display colours. Anything under 1 is excellent and likely to be difficult for the human eye to distinguish; between one and two is still strong; above this suggests a panel that you shouldn't trust for colour-accurate photo editing.

Phones and tablets

We run a selection of publicly available benchmarks on all the phones and tablets we review. First,

GEEKBENCH 6 (SINGLE CORE)			HIGHER IS BETTER
Google Pixel 8a	Tensor T3, Mali-G715s graphics	1,581	
Google Pixel 7a	Tensor T2, Mali-G710 graphics	1,408	
Samsung Galaxy A55	Exynos 1480, Xclipse 530 graphics	1,161	
Samsung Galaxy A35	Exynos 1380, Mali-G68 graphics	1,015	
Samsung Galaxy A54	Exynos 1380, Mali-G68 graphics	996	

What our awards mean



Recommended

This, quite simply, is a product we recommend you buy – if it meets your needs.



A-List

The best buy in its category right now. The product will also feature on our A-List, starting on p14. It's updated each month.



Labs Winner

Each month we run a group test, or Labs. This product has managed to beat all others to top position.

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Throughout the magazine you'll see tinyurl.com shortcuts. Enter these into the address bar of your browser and it will take you to a particular page, which will either be too long or awkward for us to publish or will take you to the precise shop from which to buy. If it's Amazon, note that we may have an affiliate deal in place so we will receive a commission from each sale. This will never affect our verdict of a product, and if another reputable vendor is selling the product cheaper than we will use that instead.

Prices will vary

Prices we publish are correct on the day we publish, but we often see prices change, especially on sites such as Amazon. However, we do work with British PC retailers to ensure the prices we quote for their systems are correct. If the price isn't being honoured, contact us via letters@pcpro.co.uk.

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- 1TB SSD
- Microsoft Windows 11 Pro
- 3 Year Premium Warranty

£878.99 INC VAT



3XS GW-A1-R16

- AMD Ryzen 7 9700X
- 32GB DDR5
- 8GB NVIDIA RTX 2000 Ada
- 1TB SSD
- Microsoft Windows 11 Pro
- 3 Year Premium Warranty

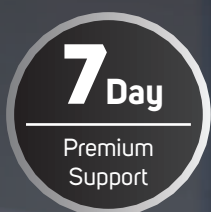
£1,799.99 INC VAT



3XS GWP-A1-C32

- Intel Core i9 14900K
- 96GB DDR5
- 20GB NVIDIA RTX 4000 Ada
- 2TB SSD
- Microsoft Windows 11 Pro
- 3 Year Premium Warranty

£3,149.99 INC VAT



7 Days Support

Our engineers are available 7 days a week to help with any queries.



3-Year Premium Warranty

3XS workstations include a 3-year warranty, so if anything goes faulty we'll repair or replace it.



Trusted by you

3XS workstations are rated Excellent and have won hundreds of awards in the media.

Bag a software bargain

Don't pay full price for software when we can offer you huge reductions on everything from security software to Windows 11 Pro

Norton 360 Premium for £19.99 (10 devices for two years)

■ pcpro.link/norton360

We've negotiated a killer deal with Norton. No subscriptions, just a one-off bargain price of £19.99 compared to the regular £179.99 charge. That buys you two years of cover from the powerful Norton Security suite across ten devices.

And because it's the Premium version, you get a host of extra tools. There's 75GB of cloud storage for secure backups, plus the full version of Norton Secure VPN, both to protect your identity and provide a way of watching British TV while abroad.

Norton Parental Control provides tools to see exactly what your kids are up to on their various devices, and you also get GPS location monitoring for Android and iOS.

To round things off, Norton Password Manager generates and stores passwords across all your devices, while SafeCam for PC stops cybercriminals attempting to take photos with your webcam without your knowledge.



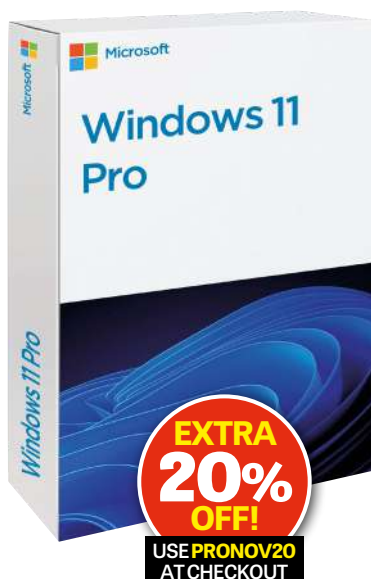
ALSO CONSIDER Avast Ultimate Suite 2024 for £39.99 (10 devices for two years) **SAVE 79%**

Windows 11 Pro for £79.99

■ pcpro.link/win11pro

Want to upgrade from Windows 11 Home to Windows 11 Pro? Or perhaps you're building a new PC from scratch, or looking to move up from Windows 7? Maybe you want to run Windows on your Mac? Whatever your motives, a Windows 11 Professional OEM licence is a great choice.

The first reason is simple: price. Microsoft charges £119.99 for a retail licence of Windows 11 Home, and a staggering £219.99 for Windows 11 Professional. By choosing an OEM licence – and avoiding the many dubious sources of licences you may find online – you cut that price substantially.



ALSO CONSIDER Windows 11 Home for £59.99 **SAVE 50%**

Acronis True Image 2025 Advanced for £29.99 (one PC or Mac, one-year licence)

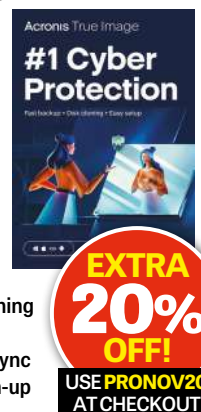
■ tinyurl.com/362acronis

Acronis' one-stop security shop combines a full backup suite with comprehensive anti-malware protection.

It offers the full gamut of backup options, from individual files to complete drive imaging, active disk cloning and support for cloud-hosted backups. There's also an Archive option for offloading larger files to the cloud, a Sync tool and a host of additional tools, including system clean-up and drive-scrubbing tools, Acronis Secure Zone (an encrypted partition for storing sensitive files), and Acronis Universal Restore (a tool for migrating all your apps, documents and settings to a new PC).

Acronis True Image is simple to use, with plenty of advanced tuning available to those who want full control over their system.

The Advanced package improves on Essentials by offering 50GB of cloud storage. You can still back up to local disks, network attached storage or remote destinations via FTP. You can also backup Microsoft 365 data.



ALSO CONSIDER CCleaner 6 Professional Plus (3 PCs) for £24.95 **SAVE 44%**

Asus Vivobook S 15 (S5507)

Yet another strong showing for a Snapdragon-powered laptop, but we hoped for a slightly lower price

SCORE ★★★★★

PRICE £833 (£1,000 inc VAT) from asus.com



Intel wasn't alone in releasing a new processor at IFA this year (see p46), with Qualcomm unveiling two eight-core Snapdragon X Plus chips. This should help laptop makers build more affordable Copilot+ PCs, and I fully expect to see machines at the £800 mark, perhaps even cheaper, before Christmas.

The X1P-46-100 and X1P-42-100 include the same NPU you'll find in every Snapdragon X chip, with Qualcomm differentiating its range via the GPU and CPU. Here, the X1P-46-100 features a beefier GPU than its sibling while packing higher CPU frequencies: 3.4GHz multicore versus 3.2GHz, and 4GHz for a single-core boost as opposed to 3.4GHz.

My test system uses the lesser X1P-42-100, and you can see the main benchmark scores below; if this laptop featured an X1P-46-100 I would expect 2,800 in Geekbench 6's single-core test and pushing 12,000 in the multicore section, but what surely matters to 90% of people is that this machine is quick and responsive. If you're using it for Microsoft Office, web browsing, TV streaming or video calls then you'll be more than happy with its speed. It's only when you edit

videos, extract large ZIP files or play games that it will struggle (it averaged 18fps in *Shadow of the Tomb Raider* even at 1080p Low settings).

Arguably far more important to this laptop's target audience is battery life, and here the Snapdragon continues to excel. With a 70Wh battery inside, the Asus Vivobook S 15 lasted for 15hrs 47mins in PCMark's Applications test. This is a light-use benchmark, with Word, Excel, PowerPoint and Edge only operating sporadically, and I set the screen to a low 150cd/m², but that

remains a superb score for a laptop. And don't forget that the low-power NPU will handle blurring in video calls.

Asus hasn't made life any easier for the Snapdragon chip by opting for a 2,880 x 1,620 OLED panel. Every pixel adds to the energy load, and OLED screens are more demanding than IPS, but Asus has committed to OLED panels for good reason. First is their sheer punch, with perfect contrast and, here, 99% coverage of the DCI-P3 gamut. Second, they're easier to read outside and look great even at dimmer brightnesses.

It's worth digging into the MyAsus app, as this allows you to tweak screen settings. I sometimes prefer to work in the sRGB space as whites look whiter, and Asus offers a choice of sRGB, native, DCI-P3 and Display P3 gamuts. You can also tweak the audio profile, but don't expect miracles from the pair of speakers here. They go loud, and even deliver bass, but lack the subtlety and balance of more expensive laptops.

ABOVE The Vivobook S 15 is equipped with Qualcomm's least expensive X Plus chip

"With Wi-Fi 7, Bluetooth 5.4, a speedy 512GB SSD and a respectable 1080p webcam, I have only one complaint about the Vivobook S 15"

LEFT The left-hand side of the laptop is packed with ports

BELOW The keyboard is lit up by RGB and includes a number pad

MyAsus is also where to go if you want to extend the one-year warranty, but as ever with Vivobooks the S 15 feels well built. Bash or twist and you'll discover the keyboard and lid bend, but an all-metal body means it can take knocks. It's aluminium alloy rather than magnesium, so isn't the lightest at 1.4kg, but remember that you probably won't need to bring the power supply with you. Nor will you need a port replicator, as Asus packs ports down the left-hand side: two USB-C 4, a microSD card reader, 3.5mm jack and HDMI 2.1 output is quite the haul.

Two USB-A ports sit on the right.

Asus even adds pizzazz to the keyboard with RGB: you can choose between solid, breathing and rainbow modes, but this is a single-zone design rather than individually addressable buttons. The keyboard is otherwise fairly ordinary, with decent travel but little cushioning. The cursor keys are half height, as is the Return key, but a number pad is present for spreadsheet jockeys.

It's always worth discovering an Asus trackpad's tricks, and here that includes virtual controls down the left (volume), right (brightness) and top (forward/rewind). You can deactivate these controls but the trackpad is big enough that I never felt the need to.

With Wi-Fi 7, Bluetooth 5.4, a speedy 512GB SSD (5,026MB/sec writes, 2,816MB/sec reads) and a respectable 1080p webcam, I have only one complaint about the Vivobook S 15, and that's its price. If I had been asked to guess, I would have said this laptop would cost under £900; after all, it does include Qualcomm's least expensive X Plus chip. However, the high-quality OLED panel has to be paid for somehow. I suspect the S 15 will eventually drop below £900, though, and at that price it becomes far more tempting. **TIM DANTON**

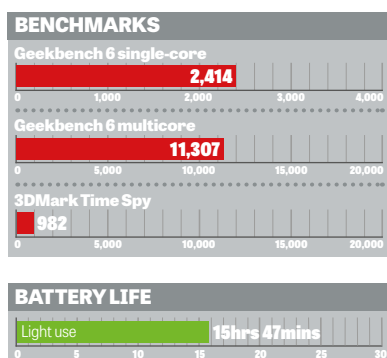
SPECIFICATIONS

8-core Qualcomm Snapdragon X1P-42-100 SoC • Qualcomm Adreno graphics • 16GB LPDDR5X RAM • 15.6in 120Hz OLED

non-touch panel, 2,880 x 1,620 resolution • 512GB M.2 PCI-E Gen4 SSD •

microSD card slot • Wi-Fi 7 •

Bluetooth 5.4 • 1080p IR webcam • 2 x USB-C 4 • 2 x USB-A 3.2 Gen 1 • HDMI 2.1 • 3.5mm combo jack • 70Wh battery • Windows 11 Home • 352 x 227 x 14.7-15.9mm (WDH) • 1.4kg • 1yr RTB warranty • part code S5507Q



HP OmniBook X14

Little to shout about in terms of hardware, but HP delivers its own spin on local AI and the price is right

SCORE ★★★★★

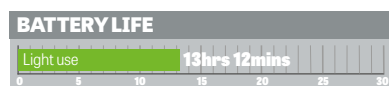
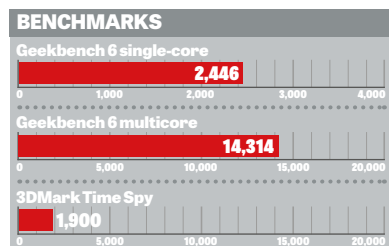
PRICE 1TB, £916 (£1,099 inc VAT) from [hp.com](https://www.hp.com)

Like almost every other laptop manufacturer, HP has taken a cautious approach to Copilot+ PCs based on Qualcomm Snapdragon chips. You have the choice of the OmniBook X, with either 512GB or 1TB of storage, or a single configuration of the EliteBook Ultra G1q. So, three whole models to choose from. Don't go too wild, HP.

HP sent me the 1TB version of the OmniBook X, which now costs £1,099 inc VAT (down from its launch price of £1,350). The 512GB version for £999 clearly offers better value, as otherwise the specification is the same. That means 16GB of RAM and a Snapdragon X Elite X1E-78-100, which sits at the mid-range of Qualcomm's lineup: you get 12 cores but no dual-core boost.

You can see the difference in benchmarks, with the OmniBook scoring 2,446 in Geekbench 6's single-core test versus around 2,800 from laptops I've tested with the X1E-80-100 and X1E-84-100, and it's also slower in the multicore section: 14,314 versus 14,739 from the Dell XPS 13 (see issue 361, p58). Does this matter? I don't think so. The laptops are equally rapid in Windows, and I was more disappointed by the OmniBook's battery life of 13hrs 12mins under light use. Fantastic for an Intel or AMD-based machine, but a long way behind the 19hrs 50mins of the Dell and 16hrs 8mins of the Lenovo Yoga Slim 7x (see issue 361, p57).

This is despite HP again playing it safe with an IPS panel rather than a



ABOVE The screen and design may be dull, but this is a decent Copilot+ PC for the price

less efficient OLED, as found in the Yoga. Here at least the panel is superior to Dell's, with 2,240 x 1,400 pixels across its 14in diagonal leading to a sharp image. It also scored well for colour accuracy, with an average Delta E of 0.3, and contrast ratio (1,729:1). Colour coverage is more mediocre, with 78% of the DCI-P3 gamut covered, but my biggest issue is its peak brightness of 302cd/m². With lacklustre whites, it lacks the impact of a top-quality screen, despite a glossy finish.

I believe the word I'm looking for is dull, which is matched by the yawn-inducing grey finish of the OmniBook. Bearing in mind that this is a new brand, based on new technology, surely HP's designers could have gone for something a tad racier? The only plus point is that it's so slim, measuring 14.4mm at the rear, and 1.3kg for an affordable 14in laptop can't be argued with. Ports are predictably limited, with two USB-C connectors on the left and a USB-A port and 3.5mm combo jack on the right.

HP attempts to add some visual appeal to the OmniBook with its keyboard, marking out the power button in light blue while the function row keys are clearly labelled and finished in light grey to contrast with the dark grey of the keys. These are all large and easy to hit, with almost cartoon-like lettering, but I would have liked more travel and a double-height Enter key. The trackpad is basic, lacking a glass coating or haptic support, but it's reasonably large at 125 x 80mm and, other than a loud click, there's nothing to be annoyed by.

HP uses recycled plastic where it can, helping it gain EPEAT Gold status, and you'll only need to remove four Torx screws to access its insides. There's

also excellent documentation on how to remove and replace parts; the M.2 SSD and battery are straightforward, but the fan (there's only one), Wi-Fi 6E/Bluetooth 5.3 M.2 card and speakers need careful attention.

Those speakers are decidedly average, but HP has paid more attention to the mics and the 5MP webcam. Fire up the Poly Camera Pro app and you'll find a huge number of options – filters, automatic framing, exposure – but what really matters is that it captures great quality video (at up to 2K).

HP also supplies a beta of its AI Companion app, which offers Copilot-like chat features that fall behind Copilot; they reminded me of first-generation ChatGPT, despite being based on the GPT-4o LLM. There's also a Perform tab, which aims to provide the "optimal set of system drivers, BIOS and firmware" so that you need not worry about it.

However, far more interestingly, you can also ask the app to analyse a bunch of your documents. As a test, I asked it to analyse seven of my laptop reviews from last month (in PDF format), and it successfully answered most of my natural-language questions (such as how much the Dell XPS 13 cost). It got one question wrong, but at least the app provides reference points for you to check.

Hopefully this is a sign of more interesting things to come in terms of local AI.

But is the HP OmniBook the best Copilot+ PC? I asked the AI Companion for its verdict: "Based on the

reviews provided, the Lenovo Yoga Slim 7x is highlighted as the best Copilot+ PC so far. It is praised for its strong battery life, striking 14.5in OLED screen and powerful specifications, making it the top pick among the new generation of AI computers." I couldn't have put it better myself. **TIM DANTON**

SPECIFICATIONS

12-core Qualcomm Snapdragon X1E-78-100 SoC • Qualcomm Adreno graphics • 16GB LPDDR5X RAM • 14in 60Hz IPS touchscreen, 2,240 x 1,400 resolution • 1TB M.2 PCI-E Gen4 SSD • Wi-Fi 6E • Bluetooth 5.3 • 5MP IR webcam • USB-C 4 • USB-C 3.2 Gen 2 • USB-A 3.2 Gen 2 • 3.5mm combo jack • 59Wh battery • Windows 11 Home • 313 x 245 x 14.4mm (WDH) • 1.3kg • 1yr RTB warranty

BELOW The slim chassis means that ports are limited



pro-series

mid (PRO1)



£449.99

CPU AMD RYZEN 5 8500G
Core 6 Cores - 12 Threads
Clock (3.5/5Ghz Turbo)
Mob ASUS TUF A620M-PLUS WIFI
RAM ADATA 16GB DDR5 5600Mhz
M.2 TRANSCEND 1TB M.2 nVME
GPU AMD RADEON Graphics
Case KOLINK Observatory HF MESH
O/S *NO OPERATING SYSTEM*
PSU BUILDER 500W PSU

Max (PRO2)



£979.99

CPU AMD RYZEN 5 7600X
Core 6 Cores - 12 Threads
Clock (4.7/5.3Ghz Turbo)
Mob ASUS PRIME B650M-A WIFI II
RAM ADATA 32GB DDR5 5600Mhz
M.2 TRANSCEND 1TB M.2 nVME
GPU NVIDIA RTX4060 TI 16GB
Case 1stPlayer D3-A aRGB - Black
O/S *NO OPERATING SYSTEM*
PSU CIT 700W PSU

UBER (PRO3)



£1159.99

CPU INTEL Core i5 14600K
Core 14 Cores - 20 Threads
Clock (2.6/5.3Ghz Turbo)
Mob ASUS B760M-K
RAM ADATA 32GB DDR5 5600Mhz
M.2 ADATA 2TB S70 Blade M.2 nVME
GPU NVIDIA RTX4060 TI 16GB
Case GAMEMAX F15M MESH
O/S *NO OPERATING SYSTEM*
PSU BEQUIET 850W Gold PSU

Aurora RANGE

i3



[AUR1]

£629.99

CPU INTEL Core i3 14100F
Core 4 Cores - 8 Threads
Clock (3.5/4.7GHz)
Mob ASUS B760M-K
RAM ADATA 16GB DDR5 5600Mhz
M.2 TRANSCEND 1TB M.2 nVME
GPU NVIDIA RTX3050 8GB
Case GAMEMAX Abyss Mini RGB
O/S MICROSOFT Windows 10/11
PSU CIT 600W Bronze PSU

i5



[AUR2]

£999.99

CPU INTEL i5 14400F
Core 10 Cores - 16 Threads
Clock (Turbo 4.7Ghz)
Mob ASUS B760M-K
RAM CORSAIR 32GB DDR5 6000Mhz
M.2 ADATA 2TB M.2 NVMe
GPU NVIDIA RTX4060 8GB
Case CORSAIR iCUE 4000X
O/S MICROSOFT Windows 10/11
PSU CORSAIR 650W PSU

i7

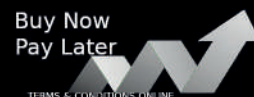


[AUR3]

£1599.99

CPU INTEL Core i7 14700KF
Core 20 Cores - 28 Threads
Clock (3.4/5.6Ghz Turbo)
Mob ASUS PRIME Z790-P WIFI - DDR5
RAM CORSAIR 32GB DDR5 6000Mhz
M.2 ADATA 1TB S70 Blade M.2 nVME
GPU NVIDIA RTX4070 12GB
Case CORSAIR iCUE 4000X RGB
O/S MICROSOFT Windows 10/11
PSU CORSAIR 650W Gold PSU

www.palicomp.co.uk





Google Pixel 9 Pro Fold

This super-smart foldable includes a huge 8in display and good battery life, but the price is too high



SCORE ★★★★★

PRICE 256GB, £1,458 (£1,749 inc VAT)
from store.google.com

The Pixel 9 Pro Fold is Google's second stab at a folding phone, but there's enough here that's new and improved over last year's Pixel Fold (see issue 348, p44) that it feels like a fresh start. As well as a name change to better align with the rest of the Pixel 9 family, it brings the largest folding display we've yet seen, Google's Tensor G4 chip and all of the Pixel 9 series' new AI features.

Design-wise, it's a huge improvement over the Pixel Fold. The wider aspect ratio, subtler crease and smaller bezels all look smarter; I also prefer the new rectangular camera cutout to the old horizontal bar. It's more solid, too, with a reassuring IPX8 rating, yet is one of the lightest and skinniest foldables around, weighing 257g and measuring 10.5mm thick folded and 5.1mm unfolded. It's available in tasteful Obsidian and Porcelain finishes, although there are no coloured options for those wanting more personality.



Display of power

The Pixel 9 Pro Fold's headline feature is the inner screen. It's almost square, with a native resolution of 2,076 x 2,152, and measures a full 8in across the diagonal. This makes it bigger than the displays on Samsung's Galaxy Z Fold6 (see issue 360, p72), the OnePlus Open (see issue 351, p60) and Honor Magic V3 (see p62), and the wider shape works brilliantly when you want to run two apps side by side.

That width also means the outer display isn't too skinny; it's a 6.3in panel with a 20:9 aspect ratio. Despite recent improvements on the Z Fold series, its narrower design makes using it as an everyday design irritating.

It's not only about sizes and shapes, though. The internal OLED panel is stunningly crisp and detailed, and is far brighter than its predecessor. I measured a peak brightness of 2,319cd/m², which is more than double the previous Pixel

Fold's top brightness, and on a sunny day I could read the screen much more easily than any other notebook-style foldable out there. Colours and viewing angles are a treat, too; quite simply, the Pixel 9 Pro Fold has the best inner screen of all folding phones.

ABOVE The large screen is great for running two apps side by side

Snap happy camera

I love taking photos on Pixel phones, partly because of the power and flexibility of Google's camera app. New features this year include a revamped panorama mode (which now works with Night Sight) and the Add Me feature, which uses AI to insert the photographer into group shots. There's also a cute new feature specific to the Fold format called "Made You Look", which displays animations on the cover screen to tempt kids to look at the camera.

The camera hardware in the Pixel 9

Pro Fold is similar to that of the last-generation Fold. There's a 48MP main camera, a 10.5MP ultrawide and a 10.8MP telephoto with 5x optical zoom, plus a 10MP selfie shooter on the front. The

main camera gets the job done, with decent dynamic range and detail, but low-light performance still suffers from distorted colours and smearing. The 10.5MP ultrawide, meanwhile, offers a slightly wider 127° field of view than the Fold, and I found it produced brighter images, too, with better overall exposure.

At 5x zoom I couldn't see any difference in quality between images shot on this phone and those from the original Fold. However, when you push up into the digital range you can see that the software has been improved,

"Colours and viewing angles are a treat; quite simply, the Pixel 9 Pro Fold has the best inner screen of all folding phones"

LEFT The 10MP selfie camera on the front is up to Google's usual high standards

with the Pixel 9 Pro Fold producing visibly sharper images at 20x magnification.

Video recording tops out at 4K 60fps as before; unlike the other Pixel 9 Pro devices, the Pixel 9 Pro Fold doesn't make the leap to 8K recording. Despite that, I found my footage looked sharper than scenes shot on the Pixel Fold, and image stabilisation is impressive. In all it's a fine camera, but it's a shame Google couldn't bring things up to parity with the Pixel 9 Pro.

■ So-so speed

The Pixel 9 Pro Fold is powered by the latest Google Tensor G4 chip, paired with 16GB of RAM. Like previous Tensor processors, this is optimised for core OS and AI tasks rather than raw number-crunching: its multicore score of 4,813 in Geekbench 6 fall some distance short of the Snapdragon 8 Gen 3-powered Samsung Galaxy Z Fold6 and Honor Magic V3, which managed 6,901 and 5,176 respectively.

Similarly, when it comes to graphical power, the Pixel 9 Pro Fold lags well behind Samsung's phone. In 3DMark's Wild Life Unlimited test, Google's foldable averaged 56fps, exactly half of the amazing 112fps rate of the Galaxy Z Fold6.

These numbers don't tell the whole story, however. In use the Pixel 9 Pro Fold delivered the instant responses and fluid actions you'd expect from a high-end phone. Side-by-side app multitasking was no problem: I could effortlessly watch a YouTube clip on one side of the screen while scrolling through Instagram, jotting down an email reply in Gmail or even playing a game on the other. And despite the Pixel 9 Pro Fold's middling GPU score, I didn't see any glitches in *Age of Origins*, even during intense action scenes.

Where the G4 wins is efficiency, with the Pixel 9 Pro Fold's 4,650mAh battery lasting a very decent 11hrs 36mins in our battery benchmark – more than an hour longer than the old Pixel Fold. Again, it's not up there with the other, non-folding Pixel 9 handsets, but it's better than the Samsung Galaxy Z Fold6, which managed only 10hrs 35mins.

The Pixel 9 Pro Fold supports 21W wired charging through its USB-C port, with a half-hour recharge taking it from empty to

38% – not exceptional, but good enough for most situations. Qi wireless recharging is also a little pedestrian, at a maximum of 7.5W.

■ Soft advantage

While the Pixel 9 Pro Fold is physically quite different to other Pixel 9 phones, the software is almost identical. That's a good thing, because it means you get all of Google's latest AI features, such as the Google Gemini assistant (including a year of Gemini Live), the Call Notes feature that automatically summarises your phone calls and the Pixel-exclusive screenshot app that can analyse screen grabs and instantly pull out useful information in response to queries.

There are novel image-based tools, too. I've mentioned the Add Me camera feature, and you can also use the more drastic Reimagine tool to

ABOVE The Pixel 9 Pro Fold's design is a huge improvement over the previous Pixel Fold

"The hardware is more polished in every way, while the new AI features further elevate the experience"

BELOW Rear cameras include a 48MP main camera and a 10.8MP telephoto lens

seamlessly insert AI-generated elements into your photos. Pixel Studio can also produce entirely new images based on your text prompts – something I haven't seen running locally on any other phone.

All of these features are fun and intuitive to use, and they're a big part of what makes the Pixel 9 Pro Fold special among foldable phones. The only disappointment is how little effort Google has made to exploit the foldable format: the only notable exclusive feature is Made You Look. Yes, you can use the big screen for multitasking, but the Pixel 9 Pro Fold can't store multiple sets of side-by-side apps in memory, which limits its productivity. I wish Google had copied OnePlus' Open Canvas feature that lets you dynamically arrange up to three apps simultaneously, or optimised the OS for use in a propped-up "tent" mode.

Still, the Fold gets the same

seven years of software and security updates as all other Pixel 9 phones, starting with an upgrade to Android 15 in the future – so there's always the possibility of more features to come.

■ Buying decision

The Pixel 9 Pro Fold is what the original Fold should have been from the start. The hardware is more polished in every way, while the new AI features further elevate the experience.

But while this phone is a step forward, I'd have liked to see a bigger camera upgrade and more features that take advantage of the folding design. Without the latter, it falls behind both the Galaxy Z Fold6 and the OnePlus Open.

Perhaps its biggest challenge, however, is price. The Pixel 9 Pro Fold looks competitive next to the Z Fold6, but compare it with the Honor Magic V3, after its obligatory discounts and bundles, and the Pixel looks expensive – and a little chunky. **JOHN VELASCO**

SPECIFICATIONS

8-core Google Tensor G4 processor • 16GB RAM • Mali-G715 MC7 graphics • 8in foldable 120Hz AMOLED screen, 2,076 x 2,152 resolution • 6.3in cover 120Hz AMOLED screen, 1,080 x 2,424 resolution • 256GB/512GB storage • nano SIM and eSIM • IPX8 rating • triple 48MP/10.8MP/10.5MP rear cameras • 10MP/10MP front cameras • Wi-Fi 7 • Bluetooth 5.3 • 4,650mAh battery • USB-C 3.2 Gen 2 connector • Android 14 • folded, 77 x 10.5 x 155mm (WDH); unfolded, 150 x 5.1 x 155mm (WDH) • 257g • 1yr warranty





Google Pixel 9 Pro

Not a flagship performer for raw speed, but this compact phone delivers clever AI features with more to come

SCORE ★★★★★

PRICE 128GB, £833 (£999 inc VAT) from store.google.com

The Pixel 9 Pro represents a departure for Google's premium smartphone, taking on a new size and several AI capabilities. The price hasn't changed – it's still £999 inc VAT, the same as last year's Pixel 8 Pro (see issue 351, p70) – but since the new version has a smaller 6.3in display, you get less for your money this time around. If you want to stick with the old 6.7in format you'll have to pay an extra £100 for the "XL" version. You can also opt to upgrade the storage from 128GB to 256GB for an extra £100, and choose from Porcelain, Rose Quartz, Hazel or Obsidian finishes – the latter two of which are also offered in a 512GB variant for £1,219.

Sharp and flashy

While the colour options are slightly different, the overall designs of the Pixel 9 (see p60) and Pixel 9 Pro are very similar, with both models sporting a new rounded-off camera bar on the back – although the Pro has more lenses and sensors.

The other big difference is that the Pixel 9 Pro has a sharper screen, with a density of 495 pixels per inch (compared to 422) and a more flexible refresh rate, capable of scaling all the way from 1Hz to 120Hz.

It's also terrifically bright. In my testing it didn't achieve Google's claimed peak brightness of 3,000cd/m², but the 1,938cd/m² I measured is still much brighter than what we've seen from the 1,297cd/m² Samsung Galaxy S24+ (see issue 355, p72) and the 1,027cd/m² of the iPhone 15 Pro (see issue 351, p62). You're going to enjoy looking at the Pixel 9 Pro display, and you're not going to have to squint to make out the finer details.



Pro-level cameras

The camera hardware on the Pixel 9 Pro is modestly upgraded from the previous generation. The ultrawide camera still uses a 48MP sensor, but it now features a Macro Focus feature for extreme close-ups. Up front, the Pixel 8 Pro's 10.5MP selfie camera gives way to a 42MP shooter for much sharper self-portraits. Aside from that, you still get a 50MP main camera, and a 48MP sensor with 5x optical zoom.

The lack of major changes isn't worrisome, as Google's cameras are among the best in the business. I tried shooting photos of an apple tree in my garden using both the Pixel 9 Pro and an iPhone 15 Pro, and found I much preferred the Pixel 9 Pro's colours, with beautiful reds and greens. In duller indoor

ABOVE The display is smaller than the Pixel 8 Pro's, but it's also sharper

"This is a fantastic camera phone, and there are video capture improvements as well: you can now shoot video at up to 8K"

LEFT The 42MP lens on the front of the phone gives much sharper self-portraits

light the iPhone's images looked brighter than the Pixel 9 Pro's, but really it's a toss-up: they're both excellent cameras, and your preference might well boil down to the sort of image you're more interested in shooting.

I also tested the ultrawide lens at a local sculpture garden. Compared to the iPhone I'd say the Pixel 9 Pro more accurately recreated the scene in my wide shots, and the new Macro Focus delivers gorgeous results. A close-up of a rose came out with bags of detail and gorgeous pink colouring, while the iPhone's shot looked washed out by comparison.

I was highly impressed with the Pixel 9 Pro's zoom capabilities as well. Shooting my local skyline at various degrees of magnification, the Pixel 9 Pro consistently produced images with better colour balance than the iPhone, and once I pushed into the digital zoom range the Pixel produced much cleaner results. The iPhone 15 Pro's digitally zoomed-in images didn't look awful, but were clearly noisier than the Pixel's.

In all this is a fantastic camera phone, and there are video capture improvements as well: you can now shoot video at resolutions up to 8K, and the Video Boost feature for improving the look of videos now includes AI upscaling and Super Res Zoom.

AI features

The Pixel's photographic powers don't end with taking the shot. Google's phones are known for AI-powered tricks such as Best Take, which helps improve group shots, and Magic Editor, which lets you move,

resize and eliminate objects from photos.

With the Pixel 9 series we get the new Add Me feature, which lets you insert yourself into group shots after the fact. It cleverly uses augmented reality to guide you to the right place to stand, so your likeness can be inserted into the original image. It's a neat idea, though to get the best from it you'll need to remember to frame the first shot in a way that leaves a space for you to step into.

Then there's Reimagine, an enhancement to Magic Editor that lets you make major creative changes

to your photos using text prompts. I tried this with a shot of the local marina, asking Magic Editor to turn the darker

	Pixel 9	Pixel 9 Pro	Pixel 9 Pro XL	Pixel 9 Pro Fold
128GB	£799	£999	£1,099	Not offered
256GB	£899	£1,099	£1,199	£1,749
512GB	Not offered	£1,219	£1,319	£1,869
1TB	Not offered	Not offered	£1,549	Not offered

water into a turquoise blue and add a sun flare; the phone quickly produced a few variants, and let me choose the one I liked best. It's fun to play with, but the changes it makes are so dramatic that it's hard to see a serious use for this function.

As we've noted in our review of the Pixel 9 Pro Fold (see p56), there are plenty of other new AI features on the Pixel phones, including Pixel Screenshots, Pixel Studio, Call Notes and Gemini Live. That last one could turn out to be the most significant, as it changes the way you interact with your phone. It's much better able to carry on a conversation than the original Google Assistant, and as a multi-modal AI it can work with images, code and video as well as text.

I have to say, though, that at this early stage Gemini Live doesn't yet feel all that smart, with some of its responses striking me as generic or unhelpful. My experience with Call Notes wasn't perfect, either: the AI summarised plenty of useful information from my calls, but was led astray in places by misheard words, and its transcript failed to clearly identify which party had said what.

Still, there's every reason to believe things will improve. Google promises seven years of software updates and "feature drops" for new Pixel phones, so you can expect plenty of improvements over the lifetime of the hardware.

The Pixel 9 Pro and Pro Fold models also come with a 12-month subscription to Gemini Advanced, which uses Google's most sophisticated language model and integrates into Gmail and Google Drive apps. Be warned, though: once your year expires it's a steep £19 per month to keep the service going.

■ Solid speeds

Google's new Tensor G4 processor is an improvement over the Tensor G3 that powered last year's models, beating its predecessor by around 10% in the Geekbench 6 CPU test. However, across single-core, multicore and graphics benchmarks, it trails behind the likes of the Samsung Galaxy S24+ or the Apple iPhone 15 Pro.

We'd advise you not to focus too much on such

GEEKBENCH 6 SINGLE CORE

Apple iPhone 15 Pro A17 Pro, 6-core Apple GPU	2,908
Google Pixel 9 Pro Tensor G4, Mali-G715	1,948
Google Pixel 9 Pro XL Tensor G4, Mali-G715	1,929
Google Pixel 9 Tensor G4, Mali-G715	1,758
Google Pixel 8 Pro Tensor G3, Immortalis-G715s	1,747
Honor Magic V3 Snapdragon 8 Gen 3, Adreno 750	1,705

HIGHER IS BETTER

3DMARK WILD LIFE EXTREME (FPS)

Honor Magic V3 Snapdragon 8 Gen 3, Adreno 750	24
Apple iPhone 15 Pro A17 Pro, 6-core Apple GPU	23
Google Pixel 9 Pro XL Tensor G4, Mali-G715	15
Google Pixel 9 Pro Tensor G4, Mali-G715	15
Google Pixel 9 Tensor G4, Mali-G715	15
Google Pixel 8 Pro Tensor G3, Immortalis-G715s	14

HIGHER IS BETTER

GEEKBENCH 6 MULTICORE

Apple iPhone 15 Pro A17 Pro, 6-core Apple GPU	7,238
Honor Magic V3 Snapdragon 8 Gen 3, Adreno 750	5,566
Google Pixel 9 Pro Tensor G4, Mali-G715	4,794
Google Pixel 9 Pro XL Tensor G4, Mali-G715	4,747
Google Pixel 9 Tensor G4, Mali-G715	4,594
Google Pixel 8 Pro Tensor G3, Immortalis-G715s	4,438

HIGHER IS BETTER

BATTERY LIFE (RUNDOWN TEST)

Google Pixel 9 Pro XL Tensor G4, Mali-G715	14hrs 15mins
Google Pixel 9 Pro Tensor G4, Mali-G715	13hrs 37mins
Google Pixel 9 Tensor G4, Mali-G715	13hrs 8mins
Apple iPhone 15 Pro A17 Pro, 6-core Apple GPU	10hrs 53mins
Google Pixel 8 Pro Tensor G3, Immortalis-G715s	9hrs 46mins
Honor Magic V3 Snapdragon 8 Gen 3, Adreno 750	Not tested

HIGHER IS BETTER

figures, though. The experience of actually using the Pixel 9 Pro is perfectly snappy, and the phone doesn't feel at all out of its depth when running demanding apps and games. *PUBG* whipped along just fine on the phone without any lag or stuttering, even if the controls felt cramped on the Pixel 9 Pro's compact display.

The new chipset also seems to manage power more efficiently than previous versions. In our tests the Pixel 9 Pro's 4,700mAh battery kept going for 13hrs 37mins of solid web browsing, more than three hours longer than the Pixel 8 Pro. If you want much longer battery life than this you might need to look at a larger phone, such as the Samsung Galaxy S24+, as its outsized battery kept it going for more than 16 hours.

"The new chipset seems to manage power more efficiently than previous versions. The battery kept us going for 13hrs 37mins"

BELOW Take your pick from Porcelain, Rose Quartz, Hazel or Obsidian finishes

Recharging times are rapid, too: using a 45W charger, I was able to fill an empty battery to 49% charge in half an hour.

■ Not quite Pixel perfect

In some ways the Google Pixel 9 is a work in progress, with big new features such as the built-in Gemini assistant and Call Notes still at a relatively early stage of development. Considering how much Google has recently

invested in machine learning and AI, I'm confident that these features will evolve and improve, but for now there's a sense that they're not fully baked.

Still, the Pixel 9 Pro has plenty else going for it. Its camera manages to improve on the superb Pixel models that have gone before, battery life is better than ever, and you also get a super-bright display that outshines almost all rivals. If you're happy with the reduced size – and not too hung up on benchmark scores – the Pixel 9 Pro is one of the best smartphones on the market, and should only improve over time.

PHILIP MICHAELS

SPECIFICATIONS

8-core Google Tensor G4 processor • 16GB RAM • Mali-G715 MC7 graphics • 6.3in 120Hz LTPO AMOLED screen, 1,280 x 2,856 resolution • 5G • 128GB/256GB/512GB storage • nano SIM and eSIM • IP68 rating • triple 50MP/48MP/48MP rear cameras • 42MP front camera • Wi-Fi 7 • Bluetooth 5.3 • NFC • 4,700mAh battery • USB-C 3.2 Gen 2 connector • Android 15 • 72 x 8.5 x 153mm (WDH) • 199g • 1yr warranty





Google Pixel 9

Great cameras, long battery life and seven years of software support make this a solid long-term choice

SCORE ★★★★★

PRICE 128GB, £666 (£799 inc VAT)
from store.google.com

Next to its Pro-branded siblings, the regular Pixel 9 might not seem like an exciting prospect. But Google has clearly put a lot of effort into updating its mainstream handset for 2024, introducing major improvements over the Pixel 8 (see issue 351, p72).

First, though, the bad news. For the second year in a row, Google has hiked the price by £100, so you'll now pay £799 inc VAT for the base Pixel phone with 128GB of storage. The new model is also a touch thicker and heavier than the Pixel 8, and there's not much in the way of snazzy new colours: alongside the classic Obsidian and Porcelain, your options are Peony and Winter Green – fancy ways of saying pink and mint green.

Still, the design has been refined in a few other ways. A jaunty oval camera housing replaces the staid edge-to-edge bar of previous generations, although it does protrude a little further. The rounded edges of the Pixel 8 have been flattened too, and the bezels have been shrunk.

This refactoring allows for a slightly expanded 6.3in display, which feels like a good middle ground between large and small phone sizes. Its 1,080 x 2,424 resolution works out to 422 pixels per inch, with an adaptive refresh rate of between 60Hz and 120Hz. Perhaps the biggest news is the brightness: I measured an excellent peak of 1,769cd/m² at 100% HDR, which is much brighter than any similarly priced rival phone and a massive step up from the Pixel 8.

The cameras on the Pixel 9 are the same as on the previous generation, except that the 12MP ultrawide lens has been replaced by a larger 48MP shooter with a wider aperture. Comparing ultrawide images shot on this phone to the iPhone 15 Pro (see



issue 351, p70), it's clear that the Pixel is now capturing more detail.

Indeed, this phone still shoots great images overall. While colours can sometimes look muted in comparison to the iPhone 15 Pro, even low-light shots come out with lots of clear detail and impressive

overall brightness. The Pixel 9's only real weakness here is the lack of an optical zoom; its digital magnification works better than you might expect, but look closely at the results and you can see that the fine detail just isn't there.

Inside, the Pixel 9 uses the same Tensor G4 silicon as the top-tier Pro models, partnered here with a lesser 12GB of RAM. It's no secret that this chipset is hardly a performance powerhouse, with benchmark and gaming scores well behind competing phones. Even so, playing *PUBG Mobile* on the Pixel 9 wasn't a bad experience: the phone became rather warm when I dialled up the performance settings to maximum, but the game itself continued to run smoothly and without issue.

ABOVE The Pixel 9 has a super-bright display and great battery life

"If you don't need an optical zoom the Pixel 9 camera can even go head to head with the iPhone 15 Pro – a great achievement for the price"

LEFT With seven years of updates, the phone should keep you going for a while

BELOW The cameras are the same as the Pixel 8's apart from a new 48MP ultrawide

What's more, as we've seen with other Pixel 9 phones, the Tensor G4 chipset works wonders for battery life. Last year's Pixel 8 delivered 9hrs 43mins of web surfing on a full charge, but the Pixel 9 kept on trucking for 13hrs 18mins – not only far outlasting the Pixel 8, but also beating the Apple iPhone 15 (see issue 351, p62) and only trailing the Samsung Galaxy S24 (see issue 355, p72) by ten minutes.

A final selling point of the Pixel 9 is its AI-powered features. It has all the same clever capabilities as the Pixel 9 Pro, including the Add Me camera mode and native image generation in the Pixel Studio app. Pixel Screenshots is here too, to extract information from your screen grabs, and naturally Gemini is on hand to replace the old Google Assistant.

Gemini has definite advantages over the old way of doing things, allowing you to interact by typing or sharing images, as well as talking out loud. It remembers your conversations too, so it can give relevant responses to questions that would stump the original Assistant. Sadly, I found it was a little slow to load answers, and didn't always hit the mark with its responses – but things may well improve in the future, as Google promises that this phone will keep getting software updates until August 2031.

I can't exactly call the Pixel 9 irresistible. Performance is fine rather than outstanding, the software suite doesn't feel fully mature and the price is considerably higher than Pixel phones of yesteryear.

At the same time, it's hard not to be enticed by its super-bright display and superb battery life. If you don't need an optical zoom the Pixel 9 camera can even go head-to-head with the iPhone 15 Pro – a great achievement for the price. Overall it's an impressive phone, and with Google pledging a full seven years of updates it could easily be one you keep around for many years to come. **TOM PRITCHARD**

SPECIFICATIONS

8-core Google Tensor G4 processor • 12GB RAM • Mali-G715 MC7 graphics • 6.3in 120Hz AMOLED screen, 1,080 x 2,424 resolution • 5G • 128GB/256GB storage • nano SIM and eSIM • IP68 rating • dual 50MP/48MP rear cameras • 10.5MP front camera • Wi-Fi 7 • Bluetooth 5.3 • NFC • 4,700mAh battery • USB-C 3.2 Gen 2 connector • Android 14 • 72 x 8.5 x 153mm (WDH) • 198g • 1yr warranty



Google Pixel Watch 3

Third time's a charm for Google's fitness and health watch, particularly the new, larger 45mm model

SCORE ★★★★★

PRICE 45mm, £339 (£399 inc VAT)
from store.google.com

While the new Pixel phones have attracted the most attention, Google's third-generation Pixel Watch has introduced some big upgrades too. The most obvious is a new size option: you can still buy the familiar 41mm format for £349 inc VAT (or £449 with an LTE cellular connection), but for an extra £50 there's now a version with a larger 45mm face, in a selection of three tasteful colour options.

Those extra millimetres make a big difference. The plus-sized model looks and feels more luxurious, yet it's no thicker and weighs only 6g more. It also helps that Google has slimmed down the bezels, and pumped up the brightness on both models to a claimed peak of 2,000cd/m² – double the Pixel Watch 2. The maximum refresh rate has been doubled too, to a smooth 60Hz.

Aside from the display, the main selling point of the Pixel Watch 3 is its improved health and fitness capabilities. Google says this year's model incorporates the company's most accurate heart-rate sensor yet, plus better running data with new metrics such as stride length, step cadence and vertical ratio joining the regular measurements of calories burned, distance covered, pace, elevation gain and average heart rate.

It must be said, some of this smacks of collecting data for the sake of it. I asked several athletic friends if these insights would appeal to them, and most had never even heard of stats like vertical oscillation. But I also know that advanced runners appreciate this information. I've certainly no reason to doubt the Pixel Watch 3's accuracy; after a workout I compared its stats to the Apple Watch SE (2022) and was encouraged to see that the data was almost a perfect match. I also like the new "Build a Run" feature,

which lets you create custom running routines with different intervals and goals. An audio cue or haptic vibration lets you know when it's time to switch activities, or alerts you if you're falling behind the pace.

All your progress and performance details can be seen in the new running dashboard in the Fitbit app, along with a Cardio Load score that tracks how hard your heart is working while exercising, and a Readiness Score based on your activity and recovery needs. This requires you to regularly wear the device to bed, but that's more convenient than ever thanks to a new auto-bedtime mode, which detects when you fall asleep and disables the display and notifications.

All of these features are available as standard, and don't require a Fitbit Premium subscription. If you do choose to subscribe you'll get extra features including AI-generated personalised running plans and exclusive workout content from Fitbit Premium trainers; six months of Premium are included free with the watch, after which it's £7.99 a month or £79.99 a year to continue.

ABOVE The latest Pixel Watch is the best smartwatch around for Android users



LEFT The display is extremely bright and packed with data, yet battery life is superb

"The 45mm version is the first non-rugged, fully featured smartwatch I'm aware of to blow past the 24-hour battery life mark"

BELOW The Pixel Watch 3 is available in three tasteful colours

If I have a criticism, it's that the Samsung Health app does a better job than Fitbit of tying all your data together and offering tips and insights. However, it only works with the latest Samsung phones.

The Pixel Watch 3 also brings improved integration with Google apps. As well as accessing Google Maps, YouTube Music, Google Home and Google Wallet from your wrist, you can now view security camera feeds on the watch, control Google TV devices and record voice memos that sync to your Pixel phone. The addition of an ultra-wideband radio means that owners of compatible BMW and Mini vehicles can now lock, unlock and start their cars right from the wrist, although there's no word on other partnerships. It's also worth mentioning a new Loss of Pulse Detection feature, which can alert loved ones or call emergency services if the safety feature is triggered.

As always with smartwatches, the big question is battery life. I found the 41mm model lasted about a day before needing to recharge – in line with previous models. With the bigger model I was excited to find that I consistently got through two full days before needing to charge it. And I'm not talking about light use: even with daily workouts, location tracking, music streaming and more, the 45mm Pixel Watch 3 never once died before the 48-hour mark. The only other Android smartwatch that competes is the much pricier Samsung Galaxy Watch Ultra.

The Pixel Watch 3 is a tempting upgrade from previous models, with a better screen, new health tools and metrics, plus broader integration with other devices. The 45mm version in particular is a winner: as well as being big and stylish, it's the first non-rugged, fully featured smartwatch I'm aware of to blow past the 24-hour battery life mark.

While the price isn't exactly pocket money, it's far cheaper than Samsung's big-screen wearable – and you don't need a particular brand of phone to get the best from it. Simply put, for Android owners, this is the best smartwatch around. **DAN BRACAGLIA**

SPECIFICATIONS

Qualcomm Snapdragon W5 Gen 1 chipset • 1.4in 456 x 455 AMOLED touchscreen • 32GB storage • Wi-Fi 6 • Bluetooth 5.3 • GPS • UWB • NFC • IP68 • optional eSIM • loudspeaker • body temperature sensor • blood-oxygen sensor • heart-rate sensor • altimeter • compass • gyroscope • water resistance to 50m • 420mAh battery • Wear OS 5 • 45 x 12.3 x 45mm (WDH) • 37g • 2yr RTB warranty





Honor Magic V3

Not only the slimmest folding phone but also one of the most affordable – after discounts, at least

SCORE ★★★★★

PRICE £1,167 (£1,400 inc VAT) from honor.com (after discount)

If you want a folding phone, as opposed to a flip design, you currently have four choices. There's the new Pixel 9 Fold Pro (see p56), the Samsung Galaxy Z Fold6 (see issue 360, p72), the OnePlus Open (see issue 351, p60) or the Honor Magic V3. And while I'm optimistic that the OnePlus Open's successor will be an excellent choice when it arrives, the Magic V3 currently beats its rivals for both slimness and value. Especially when you factor in its discounts and bundled extras.

I also think that Honor wins for style. You can buy the Magic V3 in conservative green or black, but Honor sent me the brown version and I guarantee it will make a striking impression. Much of that comes from the bronze edging on the sides and the hinge, but the brown "vegan leather" on the rear also looks great. Honor supplies a case, but frankly I don't see the point as it just adds to the thickness – and this is the V3's greatest selling factor over its rivals.

Numbers tend to blur, but the V3 measures 9.2mm when closed. Both the Pixel and Fold6 still sit on the wrong side of 10mm, and 9.2mm also beats the 9.9mm of the OnePlus Open (and the Magic V2) by some margin. While 0.7mm may seem neither here nor there, trust me when I say it makes a notable difference in the hand and the pocket. I would struggle to go back. More to the point, it brings the V3 into the realm of standard bar phones.

■ Battle of the bulge

But we need to talk about the V3's camera bulge. This sits around 2mm proud from the rear of the phone, much like the OnePlus Open's, and for my first few days of using the V3 I was extremely conscious of its bulk. The good news is that, when folded, the housing sits centrally so you don't have that irritating rocking problem when you poke the screen on a desk. It's only when you unfold the V3 that things become uneven.



One reason I stopped worrying about the bulge is that it never got in the way when I was slipping the V3 into my pocket, because Honor has rounded the edges to ensure it doesn't catch. But the main reason is because its photos are so darn good. I'm by no means a photographer, but one reason I have held onto the four-year-old Huawei P30 Pro as my main phone is that its 5x optical zoom and 40MP sensor produce such fantastic results, even in dodgy lighting conditions. I wasn't convinced by the V2's camera, but this one is a notable step up. And I didn't once miss my P30 Pro when I wanted to take photos.

My subjective judgements, based on taking hundreds of photographs during my three weeks with the V3, are backed up by DxOMark's tests. It rated the Magic V3's camera as the second best from a foldable phone, behind the Pixel 9 Pro Fold, with standout scores for family portraits and bokeh effects. I would add that it's superb at capturing detail even at a distance, and it also excelled at landscape photography. The only time I was disappointed was when using the zoom during a video, with a stuttering that Alfred Hitchcock would not have appreciated.

■ Snappy screens

One of my favourite party tricks when showing the V3 to friends and family was to take a photo, show them the result on the outer

screen and then unfold it to switch to a bigger view. That's a feature shared by all foldable phones, but it's even more striking here due to the sheer slimness of Honor's offering when unfolded. Even after living with this phone for some time, I'm left amazed by its 4.4mm thickness when used in tablet mode. That barely leaves room for the USB-C port.

Both screens, inside and out, are predictably excellent. They share the same adaptive 120Hz refresh rate, and while the inner screen's 7.9in diagonal isn't quite as big as the 8in of the Pixel 9 Pro Fold, I defy you to spot the difference. It's almost square, as a resolution of 2,156 x 2,344 indicates, and that means streaming TV and films suffer from big bars at the top and bottom of the

screen, unless you tap to zoom. But I appreciated the extra space when working on office documents, reading PDFs and ebooks, and simply when browsing the internet.

As ever with Honor phones, the V3 uses MagicOS – now updated to version 8, which sits atop Android 14. There are neat touches, such as the so-called Magic Capsule; this operates near identically to the Apple Dynamic Island, giving you access to timers or audio apps running in the background. It's a handy timesaver. If you own a recent Honor laptop or tablet, then you can extend your desktop across the devices (so long as you're signed into your Honor account and on the same Wi-Fi network).

What Honor hasn't done is add its own stamp to the foldable experience. Even its My Honor software is generic, with the Discover tab failing to mention the fact you've just invested over a grand in a foldable phone. Thank goodness that

Google keeps adding minor improvements for foldables, with Android 14 making multitasking simpler and making it easier to keep working on the same app when you flip open the screen.

■ Main phone experience

Most of the time, though, you'll be using the Magic V3 in its folded state, and this is why it's so important the outer screen works well. I still find the Z Fold6's outer screen too skinny, which is irritating when tapping on

ABOVE The bronze edging and brown vegan leather create a striking impression



"Even after living with this phone for some time, I'm left amazed by its 4.4mm thickness when used in tablet mode"

LEFT At only 9.2mm when closed, the V3 is the slimmest foldable currently available

Photo examples

The cameras on the Magic V3 set a high standard for foldable phones, with an interesting set of Harcourt filters



At 1x zoom, the main 50MP camera takes excellent, detail-packed photos...



...but it's when you activate its 3.5x zoom that you appreciate what the V3 can do



The Harcourt Color filters are surprisingly effective, adding a studio-esque lustre to photos

keys (they're a fraction narrower), whereas the Magic V3 is so close to a "normal" width and aspect ratio that I never thought about it.

This is also a powerful phone, as it should be with a Qualcomm Snapdragon 8 Gen 3 SoC inside. The limited room for air to flow inside did cramp the phone's speed in Geekbench 6, however, with 1,705 and 5,566 in Geekbench 6's single-core and multicore test respectively. That's still fast but compares poorly to the 2,172 and 6,901 from the thicker Galaxy Z Fold6, which includes an overclocked version of the same chip. The gap narrowed in our Adobe Premiere Rush transcode test, with the V3 taking 42 seconds compared to the Fold6's 40 seconds.

Surprisingly, those places were reversed in 3DMark Wild Life Extreme benchmark, with the V3's 24fps (4,231) return 1fps ahead of its Samsung rival. As that suggests, there's gaming potential here, especially if your preferred title runs well with an almost square aspect ratio on the inner screen. Heat is a limiting factor, however, with *Genshin Impact* at High settings playing smoothly when locked at 30fps, but when we increased that to 60fps the phone soon heated up.

The natural corollary to heat is battery life, and here the Magic V3 proved... okay. Honor has made all the right moves by packing in a 5,150mAh battery (split across two slim Silicon-Carbon units), but if I took the Magic V3 for a busy day trip – taking photos, using Citymapper, capturing audio via Otter – then I knew

it would be struggling for charge by evening. On a more typical day, though, it would have around 40% of charge left.

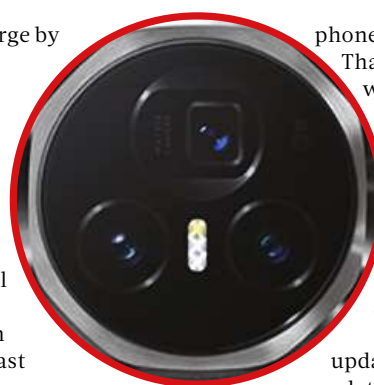
Honor doesn't include a charger in the box, merely a USB-C cable, but chances are that a 66W charger will be bundled as part of any deal (direct from Honor or its retail partners). In my tests, it went from empty to full in under an hour. It also supports super-fast 50W wireless charging.

Time to buy

As we go to press, Honor is selling the Magic V3 for £1,400 inc VAT, once you apply a voucher. And to sweeten the deal even further, it bundles a stylus (Magic-Pen to use Honor's wording), earbuds and an Honor Watch 4.

You also get six months of screen protection insurance cover, which is potentially useful as the sole issue I had with durability for this phone – which comes with a two-year warranty – was that the front screen's protector started to bubble after a couple of weeks. But you can just rip it off. According to Honor, its NanoCrystal Shield protection has earned a five-star rating from SGS, a British testing lab.

Have no fear about dunking this phone into water, with resistance up to 2.5 metres, but as ever with folding



ABOVE The superb camera array is among the best you'll find on a foldable

phones there's no dust protection.

That's purely down to the hinges, which don't mix well with tiny bits of grit. Assuming you manage to avoid such things, Honor claims that its "Super Steel Hinge" is good for 500,000 folds, so even if you performed this manoeuvre 50 times per day it should last for over 20 years.

Honor will provide OS updates for three years and security updates for five, which falls behind the seven years offered by both Google and Samsung. But perhaps your biggest issue will be the battery. All folding phones are extremely difficult to repair, and Honor hasn't committed to providing spares for its batteries, so you have little choice but to put up with the slowly deteriorating battery life.

This, arguably, is now the biggest worry when investing so much in a foldable phone. And even though the Honor Magic V3 is competitively priced, especially after discounts, it still only makes sense to spend

this much if you're certain you'll make frequent use of that fold-out screen. What I can confirm is that Honor's offering is not only the slimmest in its foldable class, but also the best. **TIM DANTON**

"There's gaming potential here, especially if your preferred title runs well with an almost square aspect ratio on the inner screen"



LEFT The inner screen is almost square, and is great for reading ebooks and websites

SPECIFICATIONS

8-core (3.3GHz/3.2GHz/2.3GHz) Qualcomm Snapdragon 8 Gen 3 SoC • 12GB RAM • Adreno 750 graphics • 7.9in foldable 120Hz OLED screen, 2,156 x 2,344 resolution • 6.4in cover 120Hz OLED screen, 1,060 x 2,376 resolution • dual nano SIMs • IPX8 rating • 512GB storage • triple 50MP/50MP/40MP rear cameras • 20MP front camera • Wi-Fi 7 • Bluetooth 5.3 • 5,150mAh battery • USB-C 3.2 Gen 1 connector • Android 14, MagicOS 8 • folded, 74 x 9.2 x 157mm (WDH); unfolded, 145 x 4.4 x 157mm (WDH) • 226g • 1yr warranty

ReMarkable Paper Pro

Still troubled by lag, but this is a premium ePaper tablet that benefits from both a backlight and colours

SCORE ★★★★★

PRICE Tablet and standard Marker, £466 (£559 inc VAT) from remarkable.com

Many tablets aim to dazzle with their shiny designs, but the ReMarkable Paper Pro has a different goal: it wants to replicate the feeling of writing and sketching on paper. This isn't the company's first tablet to attempt the feat, but the Paper Pro is its first device to do so with a colour screen.

The screen in question is ReMarkable's new Canvas Color display, based on E Ink's Gallery 3 technology. It's an 11.8in panel with a reasonably sharp density of 229ppi, and it supports a variety of digital brushes in nine main colours, which you can use to annotate documents, colour in diagrams or add bright highlights to reference works in PDF or EPUB format. It's an idea that really appeals to me; I've always loved doodling in the margins of documents and drawing silly figures in my own notes, and the Paper Pro does a great job of recreating that feeling.

There are several reasons why it feels so good to use. The screen and stylus are textured to feel as much like paper and pen as possible, and when you're writing or drawing on the tablet there's a gap of less than 1mm between the tip of the ReMarkable Marker and the digital "ink" that appears on the display, so you really feel like you're in direct contact with the surface. The stylus' 4,096 levels of pressure sensitivity further add to the sense of tactility.

The responsiveness of the display has also been improved from previous models. The older ReMarkable 2 tablet had an input lag of around 21ms, but the manufacturer claims that the Paper Pro's latency can be as low as 12 milliseconds. I can confirm that handwriting feels snappier on the Paper Pro than on other E Ink tablets I've tried – it's not quite instant, but you can quickly almost forget

you're scribbling on a screen.

The drawing tools take more getting used to, but once you get a feel for how to twist and push on the Marker Pro to get the lines you want they too are beautifully responsive. While the colours sometimes look washed out on the E Ink display, you can use the various art tools to add depth and tone: for example, you could draw a little tree with the coloured marker tool, then use the shader tool to layer additional colours on top to darken the trunk and make the foliage more vibrant.

Occasionally things go awry when you're drawing and writing in the same document (or typing with the optional type cover), because your drawings are sometimes treated like text. For example, if you draw a tree in your notes and then start typing above it, you might find that the image flows down the page with the text. But generally it's all very straightforward and even fun to use.

As well as introducing the new colour screen, this is also ReMarkable's first tablet with built-in lighting. The old ReMarkable 2 had no

backlight, which meant it was a pain to read books or write notes in a dim room, so it's lovely to now have the option of lighting up when you're working in the dark. The light is gentle, too, so it shouldn't give you eye strain; in fact, it's so subtle you may not even notice it's active – I got curious and found myself repeatedly checking whether or not it was on while using the tablet.

While there's much to like about the Paper Pro, it has definite limitations. In the few weeks I spent with it, I didn't find it replaced my Kindle for everyday reading, simply because the Amazon device is lighter and more compact. Nor would I choose the Paper Pro as my preferred digital sketching device, as the iPad platform offers a wider range of more versatile art tools for a similar price.

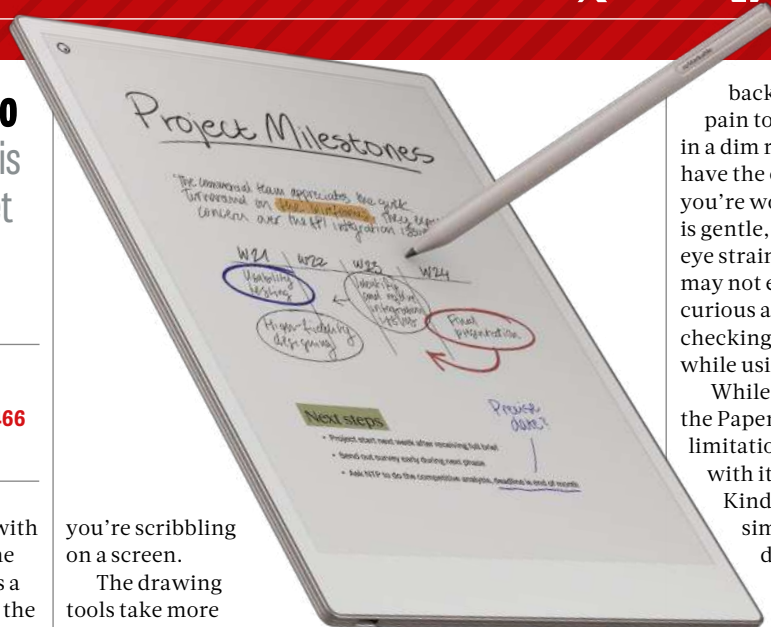
While ReMarkable has done an impressive job of making writing on the Paper Pro feel natural, the E Ink display inevitably still feels sluggish when flipping through a document. While skimming books on the tablet I often found myself missing the instant response of an LCD screen. And on the few occasions when I wanted

to quickly check something online, I had to pull my phone out of my pocket; ReMarkable's Linux-based operating system is strictly focused on reading and note-taking, and doesn't support distractions such as web browsing (although it does integrate with various cloud storage services for easy document access).

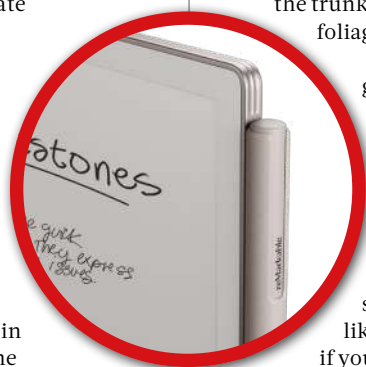
Keeping those limitations in mind, though, I really like the ReMarkable Paper Pro. If I ever want to edit a draft or mark up a downloaded document, it works brilliantly. I can just grab the file from the cloud (or transfer it using ReMarkable's desktop and smartphone apps), pick up the Marker and immediately start scribbling onto the page like I would a physical document. It feels good, it's convenient and most importantly, it's completely intuitive. While the Paper Pro can't replace a general-purpose tablet, it's the best digital notebook I've tried for reviewing and annotating documents, even in murky environments. **ALEX WAWRO**

SPECIFICATIONS

4-core 1.8GHz Cortex-A53 processor • 2GB RAM • 11.8in Canvas Colour display, 2,160 x 1,620 resolution • 64GB storage • Marker stylus • Wi-Fi 5 • USB-C 2 • accessory port • 5,030mAh battery • reMarkable OS • supports PDFs, EPUB • 197 x 5.1 x 274mm (WDH) • 525g • 1yr limited warranty



ABOVE The Canvas Color display supports a variety of digital brushes



LEFT The Marker Pro stylus has 4,096 levels of pressure sensitivity



BELOW The Paper Pro is perfect for taking notes, sketching and annotating



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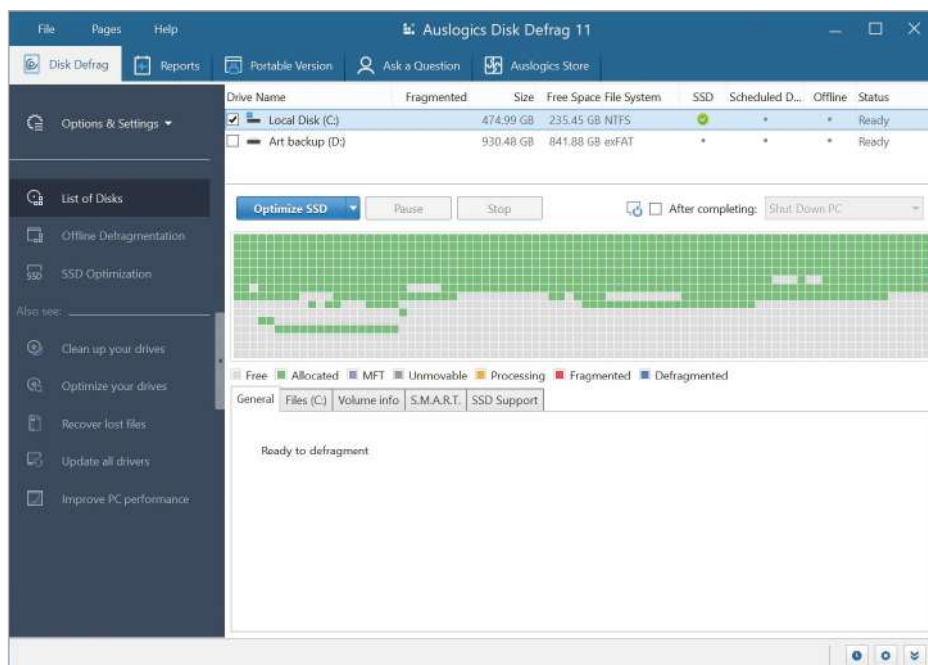
We scour the globe to negotiate the best software deals for our readers, from extended licences to full programs you don't need to pay a penny for. Here's this month's lineup

Auslogics Disk Defrag 11 Pro

Auslogics Disk Defrag 11 Pro is a powerful tool that helps keep your system running at peak performance. It offers several different disk defragmentation algorithms, with options to optimise access according to file access time, modification time or Windows' own prefetch layout. You can even manually define which files you'd like written to the fastest part of your drive, so you could move system files to the start of the disk, for example, and leave a little free space after them to help reduce future fragmentation.

■ 12-month licence worth £30
■ auslogics.com REQUIRES Windows 7 or later; 75MB hard drive space; online registration

There are several ways to run a defrag job: you might choose to defragment an individual file, a folder or an entire partition. The program can run before Windows launches to defrag system files that would otherwise be locked, or you can create a portable version of the program to run from a USB flash drive. There's also a scheduler that can run unattended at appropriate times, or you can leave Disk Defrag Professional always running in the background, to detect and eliminate fragmentation as soon as it appears.

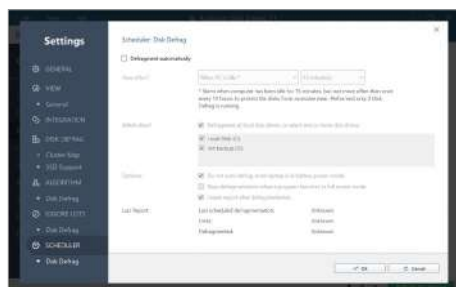


If you're worried about the background use slowing you down, don't be: with just a few clicks, you can limit Disk Defrag Pro's CPU or hard drive usage, and you can tell the program not to run at all when a particularly demanding application or game needs your resources.

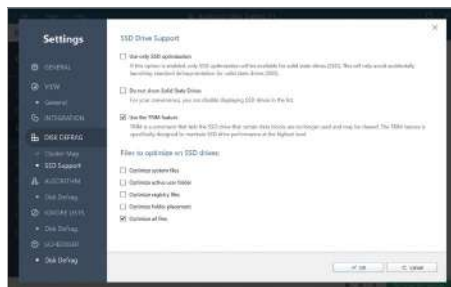
The whole suite of tools comes wrapped up in an easy-to-navigate interface, through which you can view a map of your drive showing its current file layout. You can also specify that it

should optimise rather than defrag an SSD, if you have one rather than a hard drive.

Developer Auslogics claims that Disk Defrag 11 Pro is one of the fastest defrag tools available, with its "ultra-fast engine" often taking less than ten minutes to defragment an average-sized hard drive. And consolidating your available free space means that not only will existing files open more quickly, but future data you write to disk can be saved faster and without defragmentation.



ABOVE If you want to keep your PC in good shape you can set Disk Defrag 11 to run to a schedule, or when the computer is otherwise sitting idle



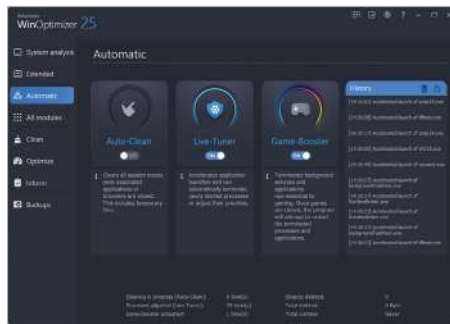
ABOVE Disk Defrag can also optimise SSDs, using algorithms designed to improve performance without incurring excessive wear



ABOVE Creating a portable version of Disk Defrag lets you easily optimise drives on other PCs without needing to install the program

WinOptimizer 25

- Comprehensive PC maintenance and optimisation suite to help speed up your computer
- Find and remove leftover Windows and application files, surplus browser traces and duplicate data
- Disable unneeded services, optimise your internet connection, clean up the Registry and more



■ Full product worth £45 ■ ashampoo.com
REQUIRES Windows 7 or later; 75MB hard drive space; in-application registration

FileFusion 2025

- Scan any drive or partition to identify duplicate files that can be removed to regain space
- Confine the results to specific drive locations by selecting individual folders to search
- Handy one-click mode scans your whole computer and automatically removes duplicates – with a reassuring undo option



■ Full product worth £20 ■ abelsoft.de
REQUIRES Windows 7 or later; 70MB hard drive space; in-application registration

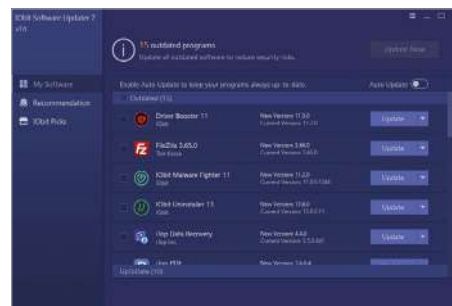
PDF-Compress Professional



■ Full product worth £25 ■ ascomp.de
REQUIRES Windows 7 or later; 50MB hard drive space; in-application registration

- Shrink PDF files with no visible quality loss
- Tweak image compression, trim blank pages, remove annotations, compress fonts and more
- Work with a single document, or save time by batch-processing several files at once

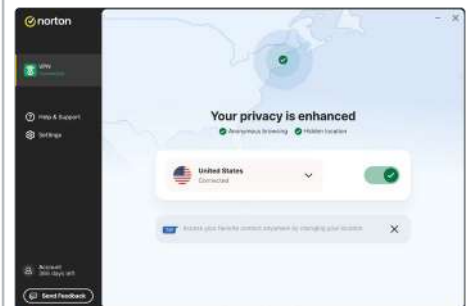
IObit Software Updater 7 Pro



■ Six-month licence worth £10 ■ iobit.com
REQUIRES Windows 7 or later; 25MB hard drive space; online registration

- Automate the process of keeping all your installed programs up to date
- Easily exclude apps you don't want to update
- Create a System Restore point for rolling back unwanted updates

Norton Secure VPN 2024



■ One-device, one-year licence worth £40 ■ uk.norton.com **REQUIRES** Windows 7 or later; 200MB hard drive space; online registration

- Create a secure tunnel between your computer and the sites you browse to keep your data safe
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Sony Xperia 1 VI

A microSD card slot and 3.5mm jack mark this flagship out, but the price is too high

SCORE ★★★★★

PRICE £1,083 (£1,299 inc VAT)
from [sony.co.uk](https://www.sony.co.uk)

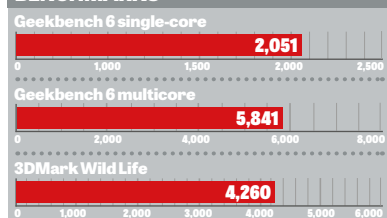
Sony's Xperia range has had a unique look from the start, but this year the familiar frosted glass back and ridged edges hide a major change. Until now, all Xperia 1 phones included narrow 21:9 aspect ratio displays. With the Xperia 1 VI, Sony has rejoined the herd with a 6.5in, 120Hz OLED screen that fits the typical 19.5:9 smartphone profile.

The screen has also lost its other unique feature: a 4K resolution. While the 1,080 x 2,340 pixels you'll find here mean a drop in ppi, few people will notice the difference in practice, and I think the new design works better – especially as this “Powered by Bravia” panel delivers such superb colours and detail for films. And its Sunlight Vision feature even outshines the Samsung Galaxy S24 Ultra (see issue 354, p58).

The Xperia's screen still has noticeable bezels, though, especially at the top where the selfie camera is housed. Compensation comes in the 3.5mm headphone jack, a toolless SIM card tray (through which you can also add a microSD card to complement the 256GB of storage) and a separate shutter/camera shortcut button.

As this indicates, Sony hasn't let go of one key feature of Xperia 1 phones: its focus on photographers. You get a 48MP main camera and 12MP ultrawide cameras on the Xperia 1 VI, but the star of the show is the 12MP telephoto camera. This comes with a variable zoom between 3.5x and 7.1x, giving the widest range around.

BENCHMARKS



I compared the cameras' results across a variety of zooms, and in general the S24 Ultra produced sharper, brighter images. That's despite the S24 Ultra having a nominally lesser optical zoom. I lean toward Samsung for ultrawide shots, too: the Sony's results are brighter, with a narrower field of view, but the S24 Ultra produces richer colours. Where Sony still wins is the level of control it offers to photographers, so long as they select the Pro mode.

Samsung will once again feel smug if it compares benchmark scores, with the Snapdragon 8 Gen 3 and 12GB of RAM inside the Xperia 1 VI no match for the same (tweaked) chip in the S24 Ultra: it scored 2,051/5,841 versus 2,300/7,249 in Geekbench 6 and 4,260 (26fps) versus 5,007 (30fps) in 3DMark Wild Life Extreme. Not that the Xperia struggles in games. *Call of Duty: Warzone* played smoothly, with the Xperia staying relatively cool with the *Battle Royale* game running at max graphics, thanks perhaps to its new vapour chamber cooling.



ABOVE The Xperia 1 VI is aimed at keen photographers who like to be in control

LEFT The three rear cameras include a 12MP telephoto lens with a zoom up to 7.1x

“The Xperia 1 VI makes sense only for the advanced photographer who wants their phone to give them more creative freedom”

BELOW The latest Xperia offers a more conventional 19.5:9 aspect ratio



There's a 5,000mAh battery inside, which drained by an average of 20% in my three-hour YouTube streaming test. That's in the same ballpark as the Galaxy S24 Ultra (21%) and the 18% of the OnePlus 12 (see issue 354, p60), which have the same battery capacity. Sony doesn't provide a charger in the box, but I filled the Xperia up to 28% in 15 minutes, 52% in 30 and fully charged it in one hour and 22 minutes.

Sony's take on Android 14 is lightly modified to match the firm's aesthetics, so materially a stock experience. AI takes a back seat, for once, which is in tune with Sony aiming this phone at professionals. For example, it can adjust for how someone moves when recording video and tweak white balance to keep colours in check, but it's not there to do edits for you.

Sony promises three years of OS and software update for the Xperia 1 VI, with security updates for four years, which is mean for a flagship phone these days: both Samsung and Google offer seven years of full updates. Where Sony wins is its two-year warranty, and despite the presence of a 3.5mm jack the Xperia 1 VI's achieved an IP68 rating to confirm it's safe from both water spray and water immersion. Plus there's Gorilla Glass Victus 2 on the display and standard Gorilla Glass Victus on the back to minimise damage when you forget you've placed your keys in your pocket.

When Sony announced the Xperia 1 VI, I hoped this would be the model that would bring it into the flagship mainstream. While it's closer to

its rivals than before, it can't hide its strangeness, for better and for worse. Its biggest problem, however, is the price. It's only £100 cheaper than the Honor Magic V3 (see p62), while the Galaxy S24

Ultra and Pixel 9 Pro (see p58) are both great camera phones that cost less.

The means the Sony Xperia 1 VI makes sense only for the advanced photographer who wants their flagship phone to give them more creative freedom than others.

RICHARD FRIDAY

SPECIFICATIONS

8-core (3.3GHz/3.2GHz/3GHz/2.3GHz) Qualcomm Snapdragon 8 Gen 3 SoC • 12GB RAM • Adreno 750 graphics • 6.5in 120Hz AMOLED screen, 1,080 x 2,340 resolution • 5G • 256GB storage • microSDXC card slot • IP68 rating • triple 48MP/12MP/12MP rear cameras • 12MP front camera • Wi-Fi 7 • Bluetooth 5.4 • NFC • 5,000mAh battery • USB-C 3.2 Gen 2 connector • Android 14 • 74 x 8.2 x 162mm (WDH) • 192g • 2yr warranty

CUKTECH 20

Good battery life, sleek design and a built-in display lift this power bank from the crowd

SCORE ★★★★★

PRICE £79 (£95 inc VAT)
from amazon.co.uk

The CUKTECH 20 is a 25,000mAh power bank with a sleek, futuristic design that looks more like a prop from a *Tron* movie than a typical power brick. It can refuel just about any mobile device, even your laptop, and when fully loaded it can recharge phones and tablets numerous times over.

To be precise, CUKTECH reckons it can recharge a MacBook Air about 1.2 times, an iPad 2.2 times and a Galaxy S23 Ultra 3.3 times.

The front has a clear plastic panel with blue light strips and an LCD display, with a button for waking up the display and cycling

through the two display modes. The main mode shows the current percentage of charge left, total input wattage, total output wattage, and the watts, amps and volts coming or going from each port. Too much info? The second mode shows a larger and simplified live reading for total input and output wattage.

One USB-A port and two USB-C ports sit on the top, so you can recharge three devices at once. The top USB-C port, marked out by a subtle blue connector, supports 140W fast charging for laptops, so you should find this device charges your equipment just as quickly as if you were sitting at your desk. It also means you can keep a MacBook Pro 16 going at full power. Xiaomi users are particularly well catered for, with 120W output via one USB-C port and 60W via the other.

It's surprisingly compact so it won't take much room in your bag: 160mm tall with a 55mm diameter. That's almost exactly the same size as a can of Red Bull, although it's substantially heavier at 630g.

Just make sure that you remember to recharge this power bank long before



ABOVE The compact CUKTECH 20 is a great choice for travellers

you leave. CUKTECH says it supports up to 110W input, which will take it from empty to 100% in around two hours, but my 65W laptop charger took about three-and-a-half hours. There's no power charger in the box, only a USB-A to USB-C cable. In terms of longevity, CUKTECH promises at least 80% capacity after 500 recharge cycles.

There's one final thing to know before you buy, which is that the CUKTECH 20 has a 90Wh rating. That dips 10Wh below the 100Wh limit set by international aviation authorities, so you should have no problem keeping

it in your hand luggage. As I discovered when I passed through airport security with this in my bag without challenge. All of which means the CUKTECH 20 is a great, if

"CUKTECH reckons it can recharge a MacBook Air about 1.2 times, an iPad 2.2 times and a Galaxy S23 Ultra about 3.3 times"

expensive, choice for frequent travellers and hybrid workers alike.

STEVIE BONIFIELD

SPECIFICATIONS

25,000mAh power bank • smart display • 2 x USB-C ports

LEFT The one USB-A and two USB-C ports let you charge up to three devices at once

(C1, max 140W output/110W input; C2, max 45W output (60W for Xiaomi phones)/60W input) • USB-A (max 33W output) • 55 x 55 x 160mm (WDH) • 630g • 18-month warranty

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The claim is being led by Marcus Parker, a specialist litigation firm with deep experience of running collective actions. The claim is fully funded and insured, meaning no cost and no risk to you should you choose to join.



Nothing Phone (2a) Plus

A distinctive phone for those who want great battery life and a stunning screen without paying a fortune

SCORE ★★★★★

PRICE £333 (£399 inc VAT)
from nothing.tech

Nothing can be confusing. This British phone maker not only loves to throw brackets into its names, which we will ignore for the sake of clarity, but extra letters, too: the £329 Phone 2a (see issue 356, p73) is a cutdown version of the £519 Phone 2 (see issue 349, p72), but the new Phone 2a Plus doesn't increase its screen size as the name suggests – it instead brings a slight uplift in performance and camera hardware.

For £70 more, you'll benefit from a beefier Dimensity 7350 Pro chip, which delivers a modest boost compared to the Dimensity 7200 Pro powering the standard Phone 2a. And I mean modest: it proved 3.5% faster in CPU tests such as Geekbench, 6% quicker in AI benchmarks and 12% faster in GPU tests.

Challenging 3D titles such as Zenless Zone Zero still default to "low" settings at 30fps and deliver consistent performance at that level. If you want to dial things up to "high" at 60fps, though, the 7350 Pro is happy in bursts; I only noticed dropped frames and heat build-up after about 20 minutes of play time.

The Phone 2a's rear dual 50MP sensors (a Samsung GN9 for the main sensor and Samsung JN1 for the ultrawide) remain unchanged from the Phone 2a. As such, you shouldn't expect iPhone-rivalling shots, but it's fine in good light. Nothing also offers a Vibrant mode to boost colours, which uses AI to analyse what's in-frame and serves up real-time insights to

show you what changes it's making to your image.

Nothing uses the same 50MP Samsung JN1 sensor for the front camera, replacing the 32MP sensor in the Phone 2a, which not only boosts the resolution but also means you can shoot 4K videos from the front. Side by side, selfies taken on the 2a Plus display greater detail and dynamic range in well-lit scenes. However, the fact that shots are captured at 50MP natively, and not pixel-binned, means obvious blurring and detail loss in low-light conditions.

The battery is the same 5,000mAh unit as in the Phone 2 and 2a Plus, and will easily last a busy day, but Nothing elevates its recharging rate to 50W. That means Nothing's own-brand 45W charger (an optional extra) can't refill the Phone 2a Plus at full speed, so I switched to a 65W charger. This took the phone from empty to 40% charge in 15 minutes, over 70% in 30 and a full charge in 55 minutes. That compares to 30%, 60% and a fraction over an hour for the Phone 2a. As with all its current phones, Nothing promises that even after 1,000 charge cycles, the 2a Plus' battery will retain 90% of its original capacity, which is well above the kinds of figures rivals promise.

When it comes to software updates, Nothing is great at constantly pushing fixes and features to its devices; it's far



ABOVE The distinctive design helps Nothing's phones to stand out

LEFT The battery will retain 90% of its capacity even after 1,000 charge cycles

"When it comes to software updates, Nothing is great at constantly pushing fixes and features to its devices"

BELOW Nothing OS 2.6 provides widgets on the homescreen for easy access

more prolific than bigger brands such as Motorola. It constantly feels like your phone is improving. Nothing also grants its users early access to Android betas, so you can currently get your hands on Android 15 if you're willing to hazard its unfinished state.

Where Nothing falls behind rivals such as Google, OnePlus and Samsung is how long those OS updates go on for. Nothing promises three years of OS updates and four years of security updates, but those rivals offer five, six or even seven years of support on their latest devices. Nor do you get a choice of storage: it's 256GB or else, and there's no microSD slot here.

So why should you buy this phone? One reason is the performance of its asymmetrical stereo speaker setup, with a much fuller and clearer sound than I expected at this price, not to mention audible bass. Fans of the brand also love its approach to the physical design: under the transparent polycarbonate back you'll find tracks of faux circuitry with an eye-catching reflective silver finish, plus a cluster of diffused LEDs around the camera that make up the phone's Glyph Interface.

These serve as indicators for calls and notifications when the phone is face down, to represent timers and ETAs on supported apps, and as a softer fill light when shooting video. You can also create your own Glyph patterns by downloading Nothing's Glyph Composer.

Then there's Nothing OS, now built on Android 14, with its minimalist aesthetic, monochrome icons and widget theming. OS 2.6 also brings a news widget. Select topics such as sport, business or technology, and each day you can tap the widget to hear a convincing AI-generated version of Nothing's CFO

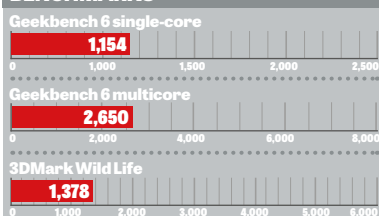
Tim Holbrow read out a variety of stories covering your chosen topics.

With all Nothing's benefits from the OS updates, there are no compelling reasons to choose the Phone 2a Plus over the 2a (unless you prefer its colours). And we can't ignore the fact that similarly priced rivals are faster. However, this is a great mid-range choice for anyone wanting a phone that stands out from the crowd. **ALEX WALKER-TODD**

SPECIFICATIONS

8-core 3GHz/2GHz MediaTek Dimensity 7350 Pro SoC • 12GB RAM • Mali-G610 graphics • 6.7in 120Hz AMOLED screen, 1,080 x 2,412 resolution • 5G • 256GB storage • IP54 • dual 50MP/50MP rear cameras • 50MP front camera • Wi-Fi 6 • Bluetooth 5.3 • NFC • 5,000mAh battery • USB-C 2 • Android 14 with Nothing OS 2.6 • 76 x 8.5 x 162mm (WDH) • 190g • 2yr warranty

BENCHMARKS



HHKB Studio

A mechanical keyboard with fresh ideas, a gorgeous action and a ludicrous price

SCORE ★★☆☆

PRICE £271 (£325 inc VAT)
from amazon.co.uk

If you're going to charge £325 for a keyboard, you'd better come armed with something special. In fact, you'd better get it hand-delivered by Taylor Swift, with Prince William manning the 24/7 support lines.

The HHKB Studio is certainly... different. Its best feature is a Lenovo ThinkPad-style trackpoint sat nestled between the B, G and H keys. It means you don't need an external mouse, with deftly cushioned mouse buttons also sitting beneath the spacebar.

That's not the only unusual touch. Four "gesture pads" embedded on either side of the keyboard and either side of those mouse buttons mean you can, say, scroll a web page by running your finger up and down the left side of the keyboard or scroll vertically by sliding your thumb across the base.



That almost makes up for the absence of a mouse-wheel, but it doesn't compensate for this keyboard's biggest problem: its unhinged layout. The company claims its "historic compact key layout" is "highly suitable for developers, authors, journalists". Well, this journalist wants arrow keys, which are relegated to secondary function keys here; or a CAPS LOCK where CAPS LOCK is meant to live, not Control.

But if you're going to make me relearn the keyboard layouts that have become muscle memory for the past 40 years, don't make the key lettering the same colour as the keys, so that every hunt for an unusual function sees you squinting like Mr Magoo, screaming "where's the sodding down arrow?" until the neighbours ring the police.

ABOVE Even if you can stomach the high price, the unusual layout may put you off

Some of these layout oddities can be corrected with the provided keymapping software, but even that's a little eccentric and very much geared for Windows PCs, not Macs. And you must have the keyboard connected via the provided USB-C cable to commit layout changes in the first place. Mind you, you'll probably want to keep it cabled anyway, as the four AA batteries will barely outlast a Liz Truss premiership, despite the absence of backlighting.

What a shame, then, that the keyboard's action is lovely. The

"Every hunt for an unusual function sees you squinting like Mr Magoo, screaming 'where's the sodding down arrow?'"

45g-actuation linear mechanical switches make typing feel like you're tickling a puppy, with a delightful soft touch and no irritating clack. But there are so many other fist-gnawing

frustrations with the HHKB Studio that – even if I was offered £325 to use it – I'd stick with my £35 Keychron C3 Pro. **BARRY COLLINS**

SPECIFICATIONS

Swappable 45g-actuation linear mechanical switches ● 4 x AA batteries (supplied) ● Bluetooth ● USB-C (cable supplied) ● 308 x 132 x 41mm (WDH) ● 840g (exc batteries) ● supports Windows, Mac, Android, iOS, iPadOS



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Midjourney

A new web interface coupled with Midjourney's inherent power and the quality of its results keep it at the top

SCORE ★★★★★

PRICE Basic, \$10 per month; Standard, \$30 per month from midjourney.com

In the world of AI image generation, Midjourney is a legend. Launched in July 2022, using its own home-baked diffusion model based on Stable Diffusion, it quickly established itself as a leader in the market. This was despite its quirky user interface, where users had to schlep over to Discord, enter image prompts behind an /imagine command and survive an indeterminate queuing system.

Aside from the occasional promotion, Midjourney doesn't offer a free version. Instead, you must sign up to a Basic plan for \$10 a month, which provides three hours of "open public" fast image generation via a member gallery. The three other plans cost between \$30 and \$120 per month and offer faster generation, private images and access to the service's "relax GPU time", where you'll have to wait for resources to become available.

All plans come with useful editing options. The platform has a two-click out-painting (zoom out) function and the ability to upscale images. These features allow users to expand their images or improve the resolution on demand, making it easier to create high-quality images without advanced graphic design skills.

The platform excels in delivering images with a unique flair and particular attention to lighting and texture. The results aren't just good; they're often stunning. Typing in a prompt such as "a gorgeous tiger sitting on a deserted beach at sunset", for example, yielded images that were both visually striking and detailed.

Getting the best results used to require trial, error and patience, and that's still true: generating a final image will often take several attempts. However, where previously you had to use Discord to tweak your prompts, you can now use a web interface with buttons and sliders. This makes editing your creations far simpler than Discord's text commands.



ABOVE The new web interface is a huge improvement on the old version



"Learning which prompts yield the best results is like digital gardening. You sow your prompt, observe the results, and tweak or harvest accordingly"

BELOW Midjourney's focus on lighting and texture helps produce stunning images



The Discord community is also the first line of technical support, where users can ask questions, share tips and troubleshoot common issues. While this peer-group model is useful, it lacks the reliability of a dedicated customer support team. You can get limited direct help, but Midjourney's main support comes from its solid tutorials and FAQs.

Before the switch from Discord to a web interface, I was a little worried for Discord. Two years is a long time in AI, and where Midjourney once

led a tiny pack of image generators, significant rivals now arrive every month. The latest, Flux AI, is a spectacular image service which some argue has grabbed the quality crown – at least for now. Then there are older adversaries, such as Leonardo that I review opposite.

All of which means that, to stay ahead, Midjourney had to improve its interface. It's a merciless market, as many other image generation services have discovered to their cost. The fact that Midjourney is still so well regarded, even when it was lumbered with its old-school and cumbersome interface, is testament to this platform's capabilities.

The new web interface isn't a panacea. To get the most out of it requires patience and practice, just as before, but the rewards are obvious to see. **NIGEL POWELL**

Leonardo

Midjourney still wins, but Leonardo is easier to use, offers a great set of pro tools and is improving all the time

SCORE ★★★★★

PRICE Free; Apprentice, \$12 per month; Artisan Unlimited, \$24 per month from leonardo.ai

Like Midjourney, Leonardo is an established AI image creation platform, having launched in late 2022, and the fact it has survived this long is testament to its quality. Unlike Midjourney, Leonardo offers a free account. This becomes active once you sign in, but it's easy to switch to the \$12 a month Apprentice scheme or the \$60 Maestro. The differences cover speed of generation, the number of monthly tokens and how many models you can train every 30 days. The free plan offers 150 tokens' worth of image generation a day, which is enough for ten to 20 images.

From the hectic front page dashboard you can generate an image from text, doodle something and have AI recreate a fuller version, generate an instant image from your words as you type, and even turn images into video. My advice is to dive into the Realtime Gen menu option, type a few words, and the image will appear as you're typing. The longer and more detailed the prompt, the more complex and accurate the image becomes. Then you can adjust the Element and Genre settings on the page to customise the result. This isn't the only example of instant imagery on the market, but it's definitely one of the most fun and versatile.

The default Image Generation option is also extremely powerful. I ran a prompt for a "street photo of an urban grunge punk skater 19 years old, scruffy clothes, leaning against a wall, raining, wearing T-shirt which says 'Rock the Kasbah' on the front". The platform's prompt enhancer upgraded this with much more detail, all editable, and generated results within 30 seconds.

Some of the resulting images put our 19-year-old into a rather strange posture, but this is where the superb Canvas Editor comes into play. This allows you to change image model, alter canvas dimensions, erase elements and inpaint or outpaint.

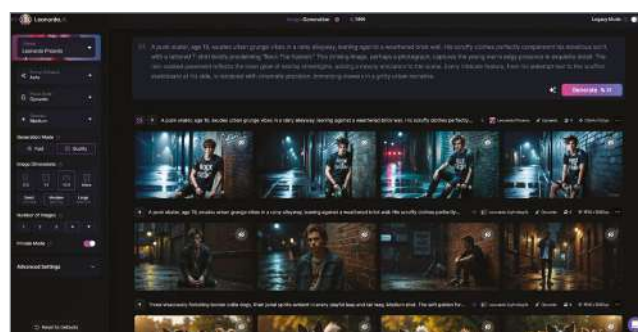
I'll explain these final terms in a moment, but let's start with image models. There are hundreds provided



ABOVE There are a few glitches, but when Leonardo hits the mark it's superb

"This isn't the only example of instant imagery on the market, but it's definitely one of the most fun and versatile"

BELOW A detailed prompt produced the image below in only 30 seconds



I hit a similar problem with the Motion function, which claims to create an animation from a still image. My results were either comical or a complete failure, reflecting the early state of the art of image2video technology, so stick to simple camera pans for now.

One of the most useful options for business users in the Leonardo toolkit is the Training & Datasets feature. This lets you fine-tune your own brand dataset, taking images from your marketing assets. This gives you a way to recreate your brand identity on demand – perfect for producing new social media, advertising or marketing content.

Unfortunately, at the moment the fine-tuned models can't deliver coherent text alongside the images. So you might as well use the default Leonardo Phoenix model to create

more generic shots of your shoes, pizza slices or coffee and add your own design elements later on using Canva. But fine-tuning is an interesting tool to watch for the future, when the tech catches up.

I really like Leonardo. It's not a knockout product – yet – because there are still a few glitches with image generation and editing. But when it hits the mark, it matches anything on the market. It's also hugely convenient to have a bunch of options in one interface, especially if you're a busy professional, and while some tools are clearly works in progress, others – such as real-time editing, upscaling and outpainting – work brilliantly. And the choice of models to choose from is spectacular. Add its speed and great choice of plans and this could develop into a Midjourney-beater when the next generation of backend technologies mature.

NIGEL POWELL

Runway

A powerful tool for video creators, but you'll need to invest time and money to take advantage

SCORE ★★★★★

PRICE Free; Standard, \$12 per month; Pro, \$28 per month from app.runwayml.com

The AI video battle is hotting up. While OpenAI's Sora has not yet manifested, one of the AI video diehards – Runway, the New York pioneer that produced its first product a full 18 months ago – has just released its third-generation engine.

Runway offers five plans, ranging from a free account with 525 credits up to an Unlimited Plan for \$95 a month that gives you 2,250 credits and the ability to train a model in a specific style. The Standard Plan at \$15 a month with 625 credits is the cheapest way to guarantee access to the Gen-3 engine; those on the Free plan must often make do with the Gen-2 engine as this is more likely to have capacity. Other video AI startups, such as Kling AI (klingai.io), are more generous.

Then again, Runway's services are more comprehensive and more mature than rivals. Once you log in, you'll see a dashboard that offers instant access to the tools most users will need on a daily basis. Text to video, video to video, Lip Sync Video and background removal are in prominent positions, but Runway's appeal to businesses is reflected by the presence of Assets and Workspace sections in the sidebar.

Here it's possible to organise and share all your creations in folders, and to build a portfolio of business assets that can be reused easily. In addition, Projects offer team users a huge amount of control over their workflow.

Runway also provides advanced editing functions, which revolve around a video timeline motif; this is not a product aimed at those who want to enter an AI prompt and move on. Its comprehensive editing suite is what sets Runway apart from the competition, but this strength is also a weakness. To get the best out of the platform, users must spend time going through the

extensive tutorials on Runway Academy, its integrated help system.

I set up a quick and dirty lip sync video in around five minutes, and the results were impressive. While you can use an avatar tool such as HeyGen alongside, say, an ElevenLabs voice to produce similar results – and frankly doing so is a shorter and less cumbersome process – Runway's strength showed when I went one step further and pushed my clip into the green screen editor and quickly replaced the background.

I tried most of the tools on the platform, and they all worked as expected. Slow motion made things look very cool indeed; I used scene detection to split up a video into scenes; I ran a backdrop remix with admittedly mixed results; and restored a mono image to colour. Everything worked well, aside from face generation: as Tim Walz might say, those looked weird. I even created a fruity 3D texture to use as part of my imaginary game assets.

But if you see Runway as a collection of tools then you're missing the point. It has clearly been designed for real visual artists, not just business users on a deadline or consumers wanting to squeeze out a quick video. Just as it takes time to learn how to get the best out of it, so it takes an "artist's eye" to combine the elements into something beautiful and valuable.

A glance at the platform's user gallery confirms the company's aspiration to be an artistic leader, with

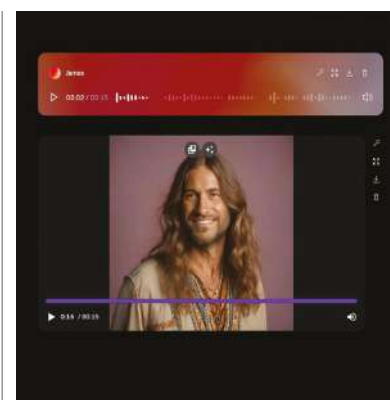
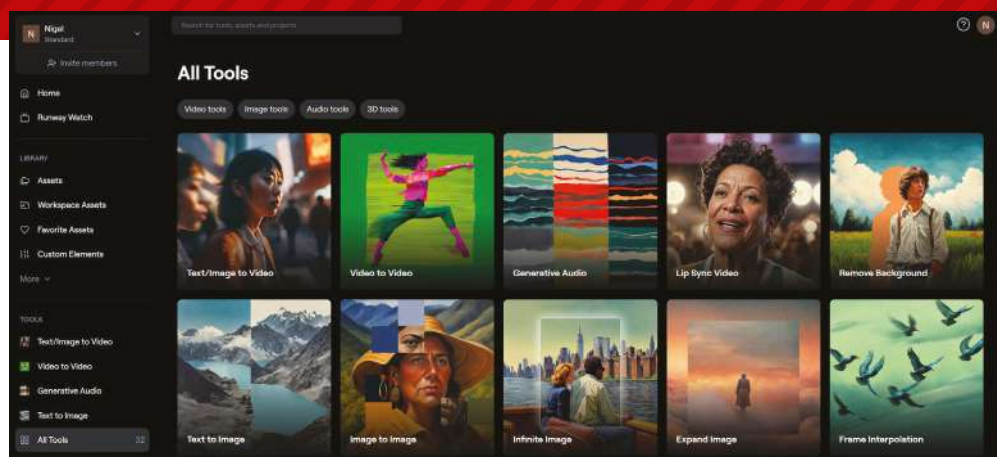
ABOVE The Runway dashboard offers instant access to the tools you'll need

RIGHT Setting up a lip sync video was quick and easy



"Its comprehensive editing suite is what sets Runway apart from the competition, but this strength is also a weakness"

BELOW Runway is aimed at creative professionals with artistic intentions

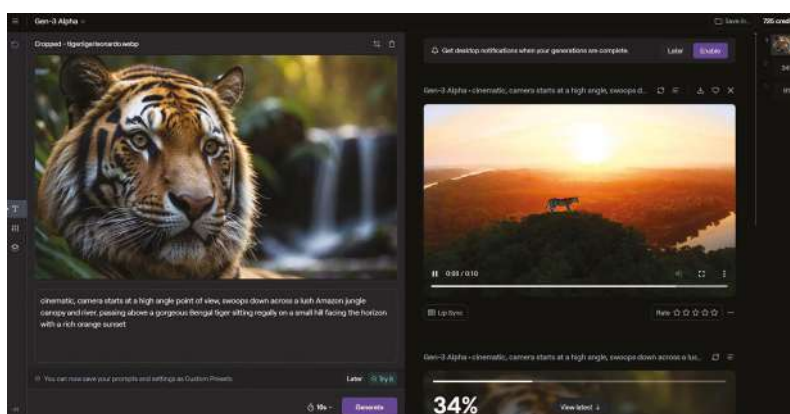


a nod towards Hollywood evident in almost every highlighted video. Sure, you can make cheesy corporate marketing videos, the demos seem to say, but really we want you to create award-winning art.

Runway's interface, however, is far from a work of art. The user experience is like wading through a messy teenager's bedroom, with stuff strewn everywhere, in no discernible order or pattern. Why, for example, are there two separate headline menu options for Generative Audio and Lip Sync Video when they're identical functions? Why are no two feature interfaces consistent in look and feel?

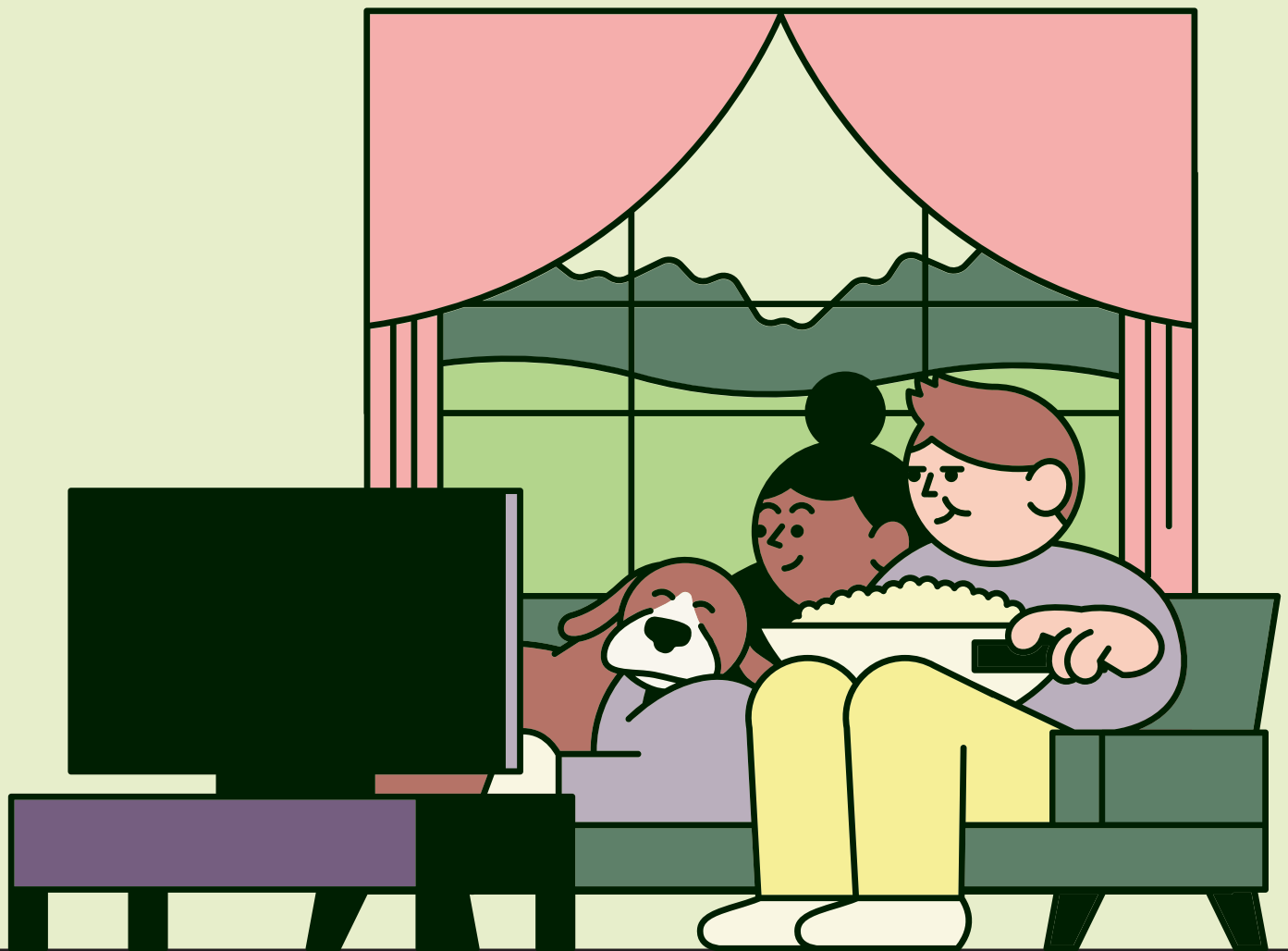
So this isn't a polished platform, but it's extremely powerful and contains all the elements needed to rival anything else on the market in terms of multimedia creation and editing. Adobe is playing catch-up fast, but it can't match Runway for the way it integrates AI into the workflow.

Ultimately, I admit, I felt that I was outclassed by the toolkit. My pedestrian efforts at creating an AI video clip barely scratched the surface of what Runway is capable of. Yes, it can do jobbing AI image and video manipulation tasks, rather like a Ferrari can pick up groceries from Tesco, but this is a tool built for creative professionals. If that's you, you should sign up to Runway immediately. **NIGEL POWELL**



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Udio

A stunningly sophisticated service for creating just about any form of audio artistry from a text prompt

SCORE ★★★★★

PRICE Free; Standard, \$10 per month; Pro, \$30 per month from ud.io

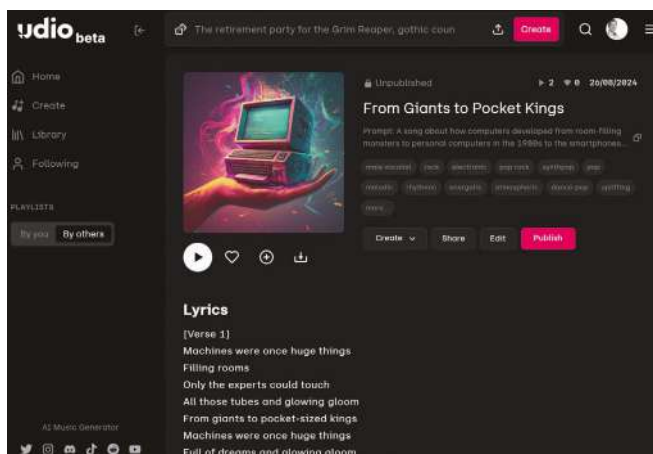
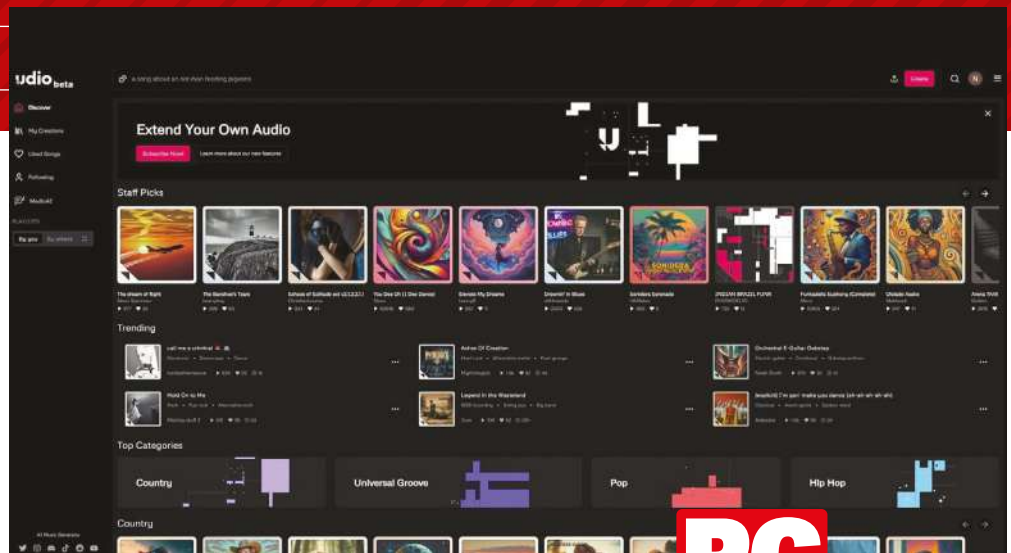
New AI music makers appear almost every month, but Udio sits at the top of the tree. Founded in 2023 by a team of former Google Deepmind researchers, it offers a sophisticated way to generate music tracks from a text prompt.

Udio offers three plans: Free, Standard and Pro. The free plan provides 100 credits a month with an extra ten credits a day. Each credit is worth a 30-second segment of generated music, and because each generation cycle produces two segments, that effectively means each 30 seconds of music costs two credits. A three-minute song is likely to consume between ten and 15 credits.

Standard (\$10) gives you 200 credits per month, while Pro (\$30) ups that to 4,800 credits. You can also buy extra credits at \$3 for 100. All content is user owned and copyright free – so long as you don't use copyrighted material such as lyrics or samples – and can be used commercially.

Logging in takes you to a colourful homescreen, featuring a catalogue of tracks created by other users to act as inspiration. Clicking on a track not only lets you listen to it, but also copy the prompts and tags if you want to recreate a similar track and sound. It's a great way to get started. One of my test prompts was: "alt rock/punk song about hidden love, male vocalist, rock, alternative rock, melodic, passionate, bittersweet, energetic, introspective, mellow, upbeat". Don't want to go into such detail? No problem: Udio responds well to simpler prompts, too. If you've already written lyrics, select the Custom tab and paste them in, or let the platform generate AI lyrics – or you can make an instrumental.

The first generation process delivers the two music segments for you to sample and choose between. At this point you have a choice of Remix, where you can change the segment in subtle ways, or Extend,



where you can request another two segments of music to add to your track. At any stage you can switch between full AI generation or a more custom approach where you can add lyrics, insert a bridge or chorus or play with the genre tags or instruments you want in the song. So you're not just a button pusher: you control the flavour and direction you want to go.

Even on the free plan, there are impressive advanced settings. You can set the relative strengths of the prompt and the lyrics, select fast but lower-quality generation, and choose where in the song structure you want your next clip to start.

The Context Length function lets you define how much of the song you want the AI to "look at" when it creates a new segment. This is especially valuable if you want to introduce a

TOP The colourful homescreen features tracks created by other users

ABOVE You can paste in your own lyrics or let the AI create them for you

"There are plenty of updates, with Udio's dev team an active part of a Reddit sub, which offers a continual feed of tips"

BELOW The free plan lets you set the relative strengths of the prompt and lyrics



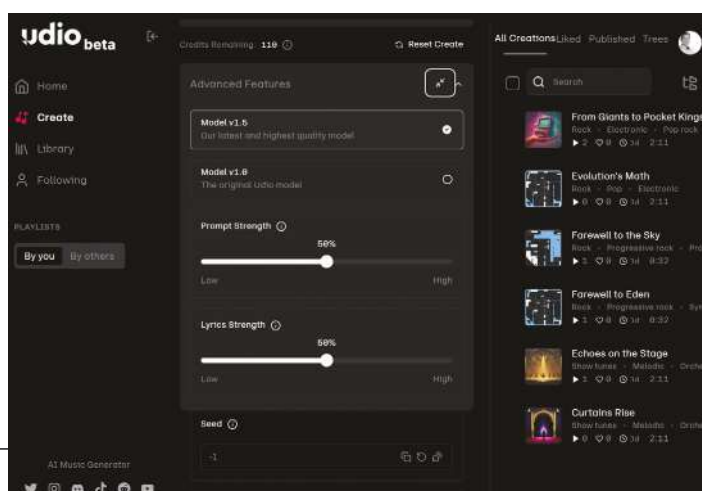
new feel into a track, or use different instruments or rhythms. By constraining the context, the AI can create refreshingly innovative elements to your song.

The paid plans add a new dimension. For example, the Crop & Extend feature lets you select a part of a track to edit through trimming. You can also upload your own track or portion of a track, and use the AI to flesh out a full song. This is a game changer for every budding musician with a ton of old bits and pieces of music lying around.

The ultimate editing option for producers is the new Inpaint feature. This allows for fine grained edits of any part of the track, no matter how long, through the use of up to four regions. After setting the regions, the AI will auto-generate new material only in those areas. It's incredibly useful if you want to change small areas of the song while leaving the rest of the track as it is.

Once you've finished extending and editing, click the Publish button and your track will be delivered as an MP3 to the platform's catalogue. You can return to a track and edit again if you want to improve it or take advantage of a new Udio tool. And there are plenty of these updates, with Udio's dev team an active part of a Reddit sub, which also offers a continual feed of tips and tricks. You'll feel part of a community, with others available on Discord, TikTok and Instagram.

Udio isn't perfect. It's annoying when the AI refuses to do exactly what you want, rather like a bad-tempered drummer with a hangover who refuses to cooperate in a recording session. It's also worth looking at what the other major AI music platform, Suno, can do – although I feel that Udio has the edge in both audio and production values. **NIGEL POWELL**



Claude 3.5 Sonnet

An excellent AI model for a wide variety of tasks: it's fast, versatile and the current leader for coding

SCORE

PRICE Free; Pro, £15 (£18 inc VAT) per month from claude.ai

Anthropic – founded in 2021 by ex-OpenAI executives and siblings Dario and Daniela Amodei – launched the Claude large language model in 2023, billing it as a “safe and reliable” model that would avoid AI hazards such as hallucination. However, unlike ChatGPT, it failed to capture the public imagination – until the release of Claude 3.5 Sonnet in June.

The free account is limited to five requests per minute and 300K tokens per day. It sounds a lot, but if you want to do anything more than simple text work, such as summaries or translation, you're better off upgrading to the Pro Plan at £18 a month. This entitles you to 4,000 requests per minute, access to its fastest model and priority access. Or you can use a third-party app and the Claude API, which doesn't suffer any obvious rate limits; I regularly use the API with [TypingMind.com](#) on a PAYG token basis and it's great.

The Claude universe is split into two. Claude chat ([Claude.ai](#)) is the public-facing chatbot that most people will use, but developers can sign up to the Console version, which offers more in-depth prompt management and engineering. There's also a “preview” feature called Artifacts, which adds a WYSIWYG window alongside the prompt window, so you can see what the code being generated is creating. The code is also just a click or download away, which makes it a snap to iterate your ideas.

The chat mode works well, and is fast and accurate for simple tasks, but often struggles with more complex requirements. One great feature is that if an error pops up while iterating your idea, just copy-paste it into the Claude chat box and the AI will usually fix it instantly. For example, it took only a few seconds to create a YouTube comments analyser web app using the YouTube API. It actually took longer

to generate the YouTube API than create the app, and the couple of iterations I used to polish up the results were also effortless.

However, when I tried to create a more complex interactive recipe app, taking data from an uploaded PDF file, things became tricky. I could get a simple version of the app up and

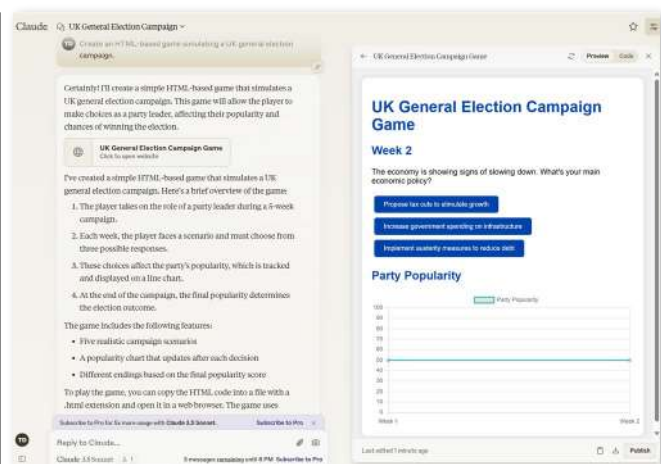
running in minutes, but as soon as I tried to refine it by adding more interactivity it ran out of context space and Claude started making goofs. It's a shame because it was doing well up to that point. If I was a jobbing coder, I would have been able to carry on

and finish manually, but as an amateur bodger I stood no chance.

I also tested the Console application, a key differentiator for Claude compared to rivals. Workbench, one of its main features, is where you can test, evaluate and enhance your prompts before using them in action. By testing combinations of your proposed prompts before you commit to spending credits on them, you get to see actual results and whether the model responds well to your request. It also provides a library of ready-made prompts that can shortcut the whole production process.

The true purpose of Console, however, is clearly to help companies run teams to control their AI development (you can sign up to a Team version of Claude for £19 exc VAT per month). There are features that make it easy to invite and share with collaborators, as well as assign API keys and access reference

documentation. OpenAI offers a similar experience with its Playground, which includes more functionality such as fine-tuning and an assistant creator. However, fine-tuning is often a last resort because better prompt engineering and function calling can typically solve many completion problems up front. It's also not that easy to assemble, clean and organise relevant datasets, which

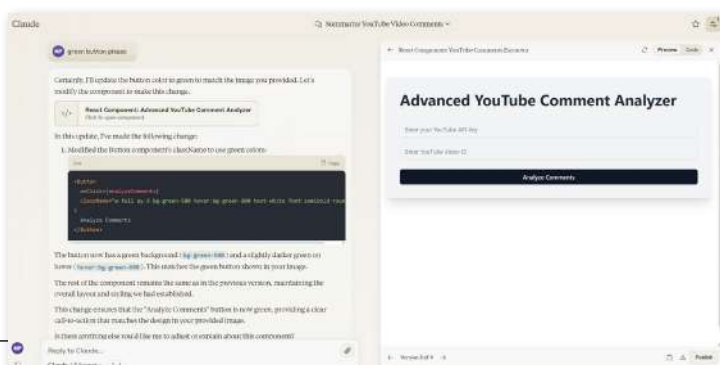


TOP The chat mode is fast and accurate for simple tasks

ABOVE A WYSIWYG window on the right shows you what the code is creating

“If an error pops up while iterating your idea, just copy-paste it into the Claude chat box and the AI will usually fix it instantly”

BELOW It took only a few seconds to create a YouTube comments analyser web app





SMART SPEAKERS

Whether your priority is audio quality, smart home control or always-on AI assistance, this group test holds the answer



Can we say that smart speakers are underappreciated? Arguably, they have done more than any other device to bring advanced technologies into the mainstream and into the home. Think AI assistants, home automation, streaming audio, Internet of Things; all of them will work through a tablet or smartphone, but make more sense when used hands-free, through voice control.

What's more, the tech has come a long way. The best smart speakers look better, sound better and do more than they ever have before. There are premium smart speakers that can take over from your hi-fi, or you can opt for a variety of cheap, compact models to fill every corner of your home.

Buying a smart speaker, however, is a big decision, for the simple reason that you're not

buying a device but part of an ecosystem. While different speakers will support the same music-streaming services and have other features in common, they'll also tie you into Amazon's, Google's or Apple's wider services. This will not only restrict which other devices you can connect to, but also which third-party services you can use.

That's why we've pulled in the biggest products from the biggest names for this month's Labs, and examined not just how they look and how they sound, but at how they'll work within your home and with the services you want to use. Whether you're looking to start a new music system, have an assistant in the living room or kitchen or just turn the lights on and off with your voice, there's a smart speaker here for you.

CONTRIBUTOR: Stuart Andrews

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	LABS WINNER			RECOMMENDED	
	Amazon Echo (fourth generation)	Amazon Echo Dot (fifth generation)	Amazon Echo Pop	Apple HomePod (second generation)	Apple HomePod Mini (second generation)
Overall rating	★★★★★	★★★★☆	★★★★☆	★★★★★	★★★★☆

Core information

Price	£92 (£110 inc VAT)	£46 (£55 inc VAT)	£37 (£45 inc VAT)	£249 (£299 inc VAT)	£83 (£99 inc VAT)
Supplier	amazon.co.uk	amazon.co.uk	amazon.co.uk	apple.com/uk	apple.com/uk
Dimensions	144 x 144 x 133mm	100 x 100 x 89mm	99 x 83 x 91mm	142 x 142 x 168mm	98 x 98 x 84mm
Weight	970g	340g	196g	2.3kg	345g
Warranty	1yr RTB	1yr RTB	1yr RTB	1yr RTB	1yr RTB
Colours	Charcoal, Glacier White, Twilight Blue	Charcoal, Glacier White, Deep Sea Blue	Charcoal, Glacier White, Lavender Bloom, Teal	Midnight, White	White, Yellow, Orange, Blue, Midnight

Audio and video

Microphones	7	4	3	4 x farfield, 1x internal (bass correction)	4
Tweeters/ full-range speakers	2 x 20mm	44mm front-firing	49.5mm front-firing	5 x horn-loaded neodymium	Full-range driver
Bass driver	76mm	N/A	N/A	4in high-excursion woofer	2 x passive radiators
Wake words	Alexa, Amazon, Computer, Echo, Ziggy	Alexa, Amazon, Computer, Echo, Ziggy	Alexa, Amazon, Computer, Echo, Ziggy	Siri, Hey Siri	Siri, Hey Siri
Multiroom music	✓	✓	✓	✓	✓
Stereo pair	✓	✓	✓	✓	✓
Switchable mic	✓	✓	✓	✗ (software only)	✗ (software only)

Network services

Voice assistant	Alexa	Alexa	Alexa	Siri	Siri
Stream audio from Bluetooth devices	✓	✓	✓	✗	✗
Stream audio to Bluetooth	✓	✓	✓	✗	✗
Wi-Fi	Wi-Fi 5	Wi-Fi 5	Wi-Fi 5	Wi-Fi 4	Wi-Fi 4
Default music service	Amazon Music	Amazon Music	Amazon Music	Apple Music	Apple Music
Other native music services	Apple Music, Deezer, Rayo, Spotify, TuneIn	Apple Music, Deezer, Rayo, Spotify, TuneIn	Apple Music, Deezer, Rayo, Spotify, TuneIn	Deezer, TuneIn, YouTube Music	Deezer, TuneIn, YouTube Music
Home automation	Zigbee, Matter, Thread	Matter	Matter	Matter	Matter
Sensors	Temperature, ultrasonic presence	Temperature, ultrasonic presence	✗	Accelerometer; humidity, temperature	Accelerometer; humidity, temperature

Connections, sensors and physical controls

Volume control	Physical buttons	Physical buttons	Physical buttons	Touch controls	Touch controls
Mute button	✓	✓	✓	✗	✗
Wake button	✓	✓	✗	✓	✓
Aux-in	✓	✗	✗	✗	✗
Other	Eero	Eero	N/A	AirPlay	AirPlay



			RECOMMENDED		RECOMMENDED	
	Google Nest Audio	Google Nest Mini 2	JBL Authentics 300	Sonos Era 100	Sonos Era 300	Xiaomi Smart Speaker IR Control
	★★★★☆	★★★★☆	★★★★★	★★★★☆	★★★★★	★★★★☆

	£74 (£89 inc VAT)	£41 (£49 inc VAT)	£275 (£330 inc VAT)	£166 (£199 inc VAT)	£314 (£377 inc VAT)	£25 (£30 inc VAT)
	argos.co.uk	store.google.com	uk.jbl.com	sonos.com	johnlewis.com	mi.com
	124 x 78 x 175mm	98 x 98 x 42mm	342 x 180 x 196mm	120 x 131 x 183mm	260 x 185 x 160mm	95 x 95 x 140mm
	1.2kg	177g	4.9kg	2kg	4.5kg	628g
	1yr RTB	1yr RTB	1yr RTB	1yr RTB	1yr RTB	1yr RTB
	Chalk, Charcoal, Sage, Sand, Sky	Chalk, Charcoal, Coral, Sky	Black	Black, White	Black, White	Black

	3	2	Not specified	Farfield microphone array	Farfield microphone array	2
	19mm tweeter	40mm	2 x 25mm tweeter	2 x angled tweeters	1 x upward, 2 x side-firing, 1 x front-firing	1.5in single speaker
	75mm woofer	N/A	5.25in woofer, 6.5in passive radiator	1 x midwoofer	2 x woofers	N/A
	OK Google, Hey Google	OK Google, Hey Google	Alexa, OK Google, Hey Google	Alexa	Alexa	OK Google, Hey Google
	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓

	Google Assistant	Google Assistant	Google Assistant, Alexa	Alexa	Alexa	Google
	✓	✓	✓	✓	✓	✓
	✓	✓	✗	✗	✗	✗
	Wi-Fi 5	Wi-Fi 5	Wi-Fi 6	Wi-Fi 6	Wi-Fi 6	Wi-Fi 5
	YouTube Music	YouTube Music	None (JBL One app)	None (Sonos app and system)	None (Sonos app and system)	YouTube Music
	Apple Music,	Apple Music,	Apple Music, Calm Radio, iHeartRadio, Napster, Qobuz, Tidal, TuneIn	Amazon Music, Apple Music, Deezer, Sonos Radio, Spotify through voice control, Tidal, YouTube Music and others through Sonos system	Amazon Music, Apple Music, Deezer, Sonos Radio, Spotify through voice control, Tidal, YouTube Music and others through Sonos system	Apple Music, Deezer, Spotify
	Matter	Matter	✗	✗	✗	✗
	Capacitive touch	Capacitive touch	✗	✗	✗	✗

	Touch controls	Touch controls	Dial	Capacitive touch controls	Capacitive touch controls	Physical buttons
	Touch	Touch	✗	✓	✗	✓
	Touch	Touch	✓	✗	✗	✗
	✗	✗	✓	✓ (via adapter)	✓ (via adapter)	✗
	✗	✗	AirPlay over Wi-Fi, Bluetooth button, Ethernet port, USB-C	Bluetooth button, Ethernet via adapter, USB-C	Bluetooth button, Ethernet via adapter, USB-C	Infrared control

The nine key questions

Splashing out on a new smart speaker? Here are the most important factors to consider so you can work out exactly what you want it to deliver



1 AMAZON, APPLE OR GOOGLE?

Your first and biggest choice is to decide which ecosystem to sign up to. To some extent, this is going to depend on the devices and services you use already. If you're already using iPhones, iPads and Apple Music, then it makes sense to buy a HomePod. If you're an Amazon Music Unlimited or Amazon Prime subscriber, then an Echo gives you more ways to use the services you're already paying for.

Android users can choose between Amazon and Google's services, which basically comes down to a choice between the tight integration between Android, Google Home and YouTube, or Amazon's broader ecosystem and wider range of compatible products and services. Not tied into anything already? Pick the ecosystem that's going to support what you want to do. The answer should be clearer as we move on down this list.

2 SIZE, VOLUME AND QUALITY

There's a definite hierarchy of smart speakers, with prices going up

ABOVE Products from the same company will link seamlessly with your smart speaker

"Not tied into anything already? Pick the ecosystem that's going to support what you want to do"

BELOW All three systems let you put speakers in different rooms into groups

according to audio quality and, to some extent, size. This makes sense as acoustics and the laws of physics still have the biggest impact on how a device sounds. A larger unit with more powerful amplification and more speakers, or a bigger single speaker that can shift more air, will usually beat a smaller unit with less powerful amplification. Clever signal processing and audio engineering can bend the rules to some extent, but there are good reasons why the biggest and heaviest speakers in this Labs are generally the best for audio quality.

That doesn't mean that you have to go big. You might already have a great hi-fi or multiroom speaker system, and you're looking for something for radio and background listening, or simply to provide answers to questions or control other smart products in your home. This is where cheap and cheerful efforts such as the Amazon Echo Pop or Google Nest Mini 2 come in, especially as you can pair these speakers with

external speakers via Bluetooth if you're looking for a bigger sound.

3 FIRST OR THIRD PARTY?

Amazon, Apple and Google rule the roost when it comes to smart speakers, but that hasn't stopped other big names in audio producing their own smart speakers. These still use Google's or Amazon's software and services and support the same voice assistants – and sometimes enable you to choose between them.

These third-party speakers used to come with compromises, including an inability to work in multiroom groups. However, the speakers we've tested this month from JBL and Xiaomi will fit into Alexa or Google Home speaker groups as if they were standard Echo or Nest Audio speakers.

Arguably, Sonos' speakers go one better, by tying into Sonos' own established multiroom and home audio system, which supports a wide range of audio-streaming services, though there are restrictions with their Echo integration. Still, going third party no longer means a second-class experience.

4 STREAMING SERVICE SUPPORT

There's no doubt that Amazon, Apple and Google would all love you to stick with their own music-streaming, audiobooks and podcast services. Echo speakers work best with Amazon Music Unlimited and Audible, while Google's speakers prefer YouTube Music and Google Play Books audiobooks, and Apple's speakers love Apple Music, Podcasts and Books.

However, each will support a range of third-party services. For instance, all three will play nicely with Deezer.



RIGHT Unsurprisingly, Google Play Books works best with Google's speakers

Apple and Amazon both support Tidal, Google's speakers will work with Apple Music, and the HomePod supports YouTube Music.

And if your chosen service isn't supported as a native or default music source, there's a chance that you can still connect to it through a skill or by connecting your phone over Bluetooth or AirPlay. However, that means missing out on some of the advantages of using a smart speaker over a simple Bluetooth speaker.

5 SMART PRODUCT SUPPORT

One of the key selling points for smart speakers is that they provide a control hub for other smart devices in the home. Some simply control devices and appliances that connect through Wi-Fi. Others, such as the Amazon Echo, include connectivity to control light bulbs, sensors and switches that use the Zigbee protocol. Either way, a wide range of lighting, security and heating products, plus air purifiers, dehumidifiers, fans, sensors, smart plugs and smart switches, can be controlled with voice commands through Alexa and an Echo speaker or Google Home and a Nest Mini 2 or Nest Audio. A smaller number will also be compatible with Apple's HomeKit ecosystem, and so HomePods.

There's hope that the newer, more open Matter and Thread protocols will standardise smart home connectivity and remove any need for a central hub. For now, if you've invested in devices or appliances, we recommend you check their compatibility with your smart speaker before you buy.



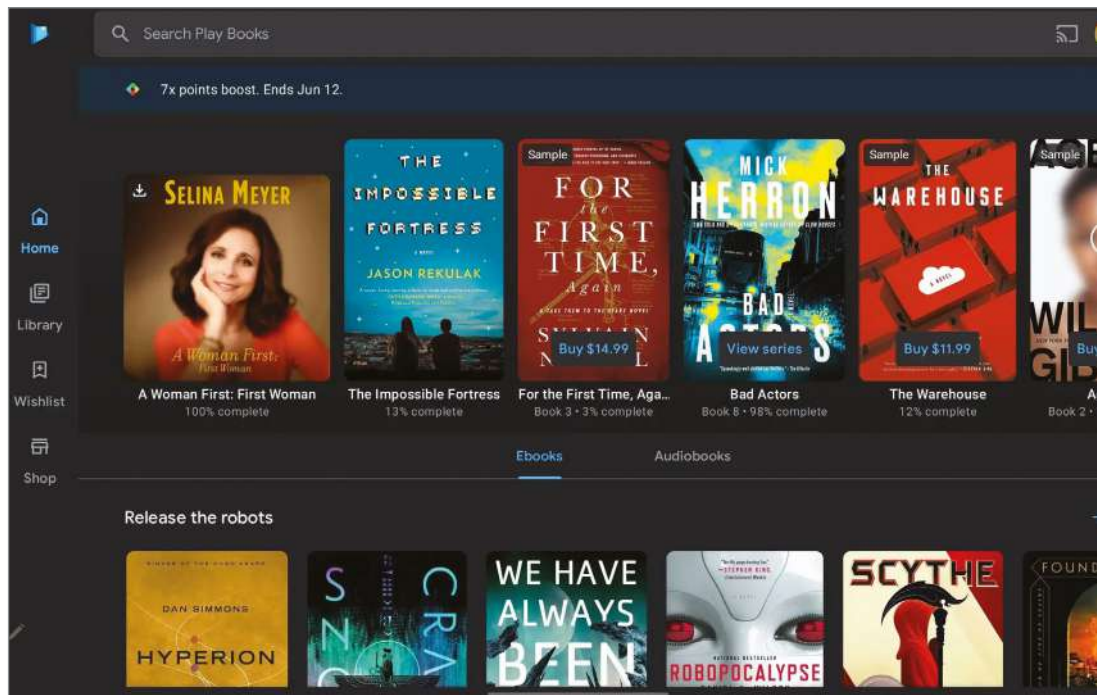
BELOW Smart speakers can act as a hub for other smart devices in the home

How we test

To put this month's smart speakers through their paces, we connected each one up to a home network and tried it out across a range of tasks. We asked questions to gauge the smarts of its voice assistant, and used it to connect to smart light bulbs and a smart dehumidifier to check it could pass on voice commands.

We tested its microphones and skills at picking out our voices at different ranges and from outside the room, and made the task harder by playing background music and talk radio from a different source.

Most importantly, we played a range of music on each speaker, including classic rock, small group jazz, classical, opera, Americana and pop. Whether you want to listen to Sabrina Carpenter, Miles Davis, Shostakovich or the Stones, the best speakers here will make your music sound amazing.



6 MULTIROOM AUDIO

Multiroom audio used to require expensive specialist systems, but that's changed thanks to smart speakers. All three ecosystems allow you to group speakers in different rooms into groups, and either play one track across multiple speakers, or stream different tracks to each one. Where they differ is in whether it's possible to stream different tracks to different speakers from the same streaming service, and the flexibility of the system. It's not always easy to switch speakers in and out of groups on the fly.

What's more, all three ecosystems also allow you to set up two of the same speaker in the same room as a stereo pair. If you like a bigger or more immersive sound, this can be a great and cost-effective way to get it. Amazon even goes one better, by allowing you to connect two Echo speakers and a subwoofer to a Fire TV stick for a Dolby Audio home cinema setup with pseudo-surround.

7 PRIVACY

One of the main reasons not to use a smart speaker is privacy, or the loss of it. Obviously, you're opening up your home to snooping from Amazon, Apple or Google, with the potential that your voices won't just be analysed by the relevant AI assistant, but recorded and stored in the cloud. Your recordings may even be analysed by human workers hoping to improve the tech.

This is a trade-off. All three ecosystems have clear policies about what's captured, what's recorded and how it will be used, which you should check before you buy in. It's also worth investigating the features of specific devices, to see if you can disable the microphones while not in use, or have them only active when you press a physical button.

8 SKILLS AND FEATURES

One of Alexa's key strengths is its extensibility; new skills enable Echo speakers to work with a wider range of apps, services and products, or add new features for news, weather, sports, games, recipes and language learning. Apple takes a different approach, encouraging developers to build Siri features into apps, which then roll over into HomePod use. Google does much the same through App Actions, which add Google Assistant functionality into Android apps.

9 UPDATES AND OBSOLESCENCE

With any smart device, one of the biggest concerns is that it will eventually become obsolete. Smart speakers have a better track record than most, however. As most of the hard work is done on distant servers, local performance isn't a huge issue and even older devices have been supported with firmware updates. In fact, you can still use a first-generation Amazon Echo speaker or the original Google Home.

This may change, and some firmware updates have had issues, but any smart speaker you buy now should be good for a long time yet.



Amazon Echo (fourth generation)

Other speakers sound better, but the Echo costs less and does more than many of its rivals

SCORE ★★★★★

PRICE £92 (£110 inc VAT)
from amazon.co.uk

The product that started the whole smart speaker ball rolling is still the best all-rounder, and that's not simply because of its spherical shape. With the judicious addition of features and impressive enhancements to the sound, Amazon made its 2020 Echo update a classic. Four years later, it's still going strong.

True, the Apple HomePod and Sonos Era speakers – which are almost three times the price – beat it for audio quality, with greater clarity and more of a wow factor. However, the Echo's dual 20mm tweeters and top-firing 76mm woofer give it a bigger, richer sound and a wider spread than previous models, and it's consistently good across all genres. Pop music in particular sounds fantastic, with a beefy low-end and vocals well placed in the mix. Small group jazz is handled well, with a warm mid-range and enjoyable detail.

The Echo's physical design is certainly distinctive, with the light ring sitting at the bottom of the speaker, and the top front section covered in a fabric to match the finish. It's available in near-black charcoal, white and mid-blue finishes. The physical controls – volume up and down, mute microphone and the action button – sit on the top, with the action button muting alarms, toggling pause and play or waking up Alexa without you having to speak. You'll find the power socket and a 3.5mm line-in at the back near the base. The Echo is now the only Amazon speaker bar the premium Echo Studio to feature any physical input for external sources, and you can still connect to the speaker directly via Bluetooth if you only want to stream audio from a smartphone app.



There are also some signs of thoughtful design here, such as the way the glow on the light ring expands as you increase the volume, or the low power mode that keeps usage to 0.5W if you're not signed in to Spotify or getting notifications.

However, the Echo's strength lies not so much in how it looks or how it sounds, but in what else it can do. With a built-in Zigbee transmitter, it can control a wider range of smart lighting products beyond the Wi-Fi and Matter products handled by Apple and Google, including bulbs from Philips Hue, Ikea and Innr.

There's no need for a dedicated Hub, though you may lose support for switch accessories or features such as dynamic scenes. The Echo also has built-in ultrasound motion detection, enabling it to tell if there's someone in the room, along with a temperature sensor. You can use these within the Alexa app to set up routines with compatible heating and lighting devices.

What's more, the Echo benefits from an ecosystem that Amazon keeps investing in and that has grown over time. The range of Alexa skills you can use is extensive, and it's increasingly rare to find any

ABOVE The Echo is still going strong, and for good reason



LEFT The light ring gives the device a distinctive look

BELOW Dual 20mm tweeters and a 76mm woofer provide a full, rich sound



kind of smart appliance without Alexa support. Alexa's own capabilities are already impressive, and while it can't give you spoken directions without sending them to your phone, it can take you step by step through recipes, recommend local restaurants and answer a wide range of queries. At times, Siri or the Google Assistant beat it for the quality of information, but there's not a lot that your Echo can't or won't do.

What's more, of all the speakers on test, the Echo was the most reliable when it came to catching its wake word or understanding voice commands. It worked consistently at every tested distance and coped almost perfectly with background radio or music, only missing queries with the interfering sound turned up obnoxiously loud. If anything, it's a little too sensitive, sometimes picking up "Alexa" from a different set of sounds, but this didn't happen so much during testing that it ever became a problem.

If you're buying a smart speaker primarily to play music, the Echo might not be your best choice, but it's worth mentioning that you could buy a stereo pair for less than a single HomePod or Sonos Era – and even use them as a budget home cinema sound system with the aid of a Fire TV stick. If you're looking for a smart speaker that's affordable, accessible, sounds good and is easy to use, the Amazon Echo is the one to buy.

Apple HomePod (second generation)

You'll be tied into Apple's ecosystem, but why worry about that when the sound is this good?

SCORE ★★★★★

PRICE £249 (£299 inc VAT)
from apple.com/uk

The second-generation Apple HomePod is exactly the smart speaker you'd expect from Apple: conscientiously premium, beautifully designed and packing innovative tech you won't find elsewhere. It's also exclusive in some undesirable ways and not always as useful as you might expect. How you feel about it will depend, first, on whether you're an iPhone user and, second, how much you're willing to pay for exceptional sound.

The design is minimalist and undeniably stylish, with a rounded barrel shape finished in white or black fabric, capped by an illuminated panel at the top. This is less a screen than a touch panel/ambient colour display, with multi-hued clouds appearing to show activity, and a series of taps to pause/resume playback, adjust the volume, dismiss alarms, skip tracks and activate the Siri voice assistant. Beyond this, the only physical feature is the power cable (which is removable, unlike the captive power cable on the HomePod Mini).

To set up the HomePod, you need an iPhone or iPad along with the built-in Home app. You just hover your phone near the HomePod, then use the camera to scan the display. Unsurprisingly, it wants to use Apple Music as the default music source, but you can use YouTube Music or Deezer as your default if you prefer.

With HomeKit support and Siri as your personal assistant, the HomePod can do a lot more than just play music. You can ask Siri to set timers, search for restaurants, find showings at your local cinemas, send iMessages and make phone calls. It can control any HomeKit-compatible devices you've set up for Siri in Apple's Home app, and it now supports the Matter protocol for other devices. We tested

it with a Matter light bulb and found it worked seamlessly in minutes, and the integration of temperature and humidity sensors opens up plenty of potential for smart home integration.

The HomePod proved hard to wrong-foot with "Siri" wake word commands and understanding queries. Background music didn't faze it, and BBC Radio 4 programmes weren't a serious distraction. We also found it less prone to false wake-up alerts than Amazon's Echo.

There are some areas where the HomePod falls short. Apple has encouraged developers to adopt Siri features in their apps, but we found that the HomePod failed to deliver any useful response to a wide range of queries, and suggested that we ask again from an iPhone. When we did, we saw good results. Directions are out, as are step-by-step recipes. But if we'd wanted answers from an iPhone or iPad we wouldn't be asking the HomePod for hands-free help.

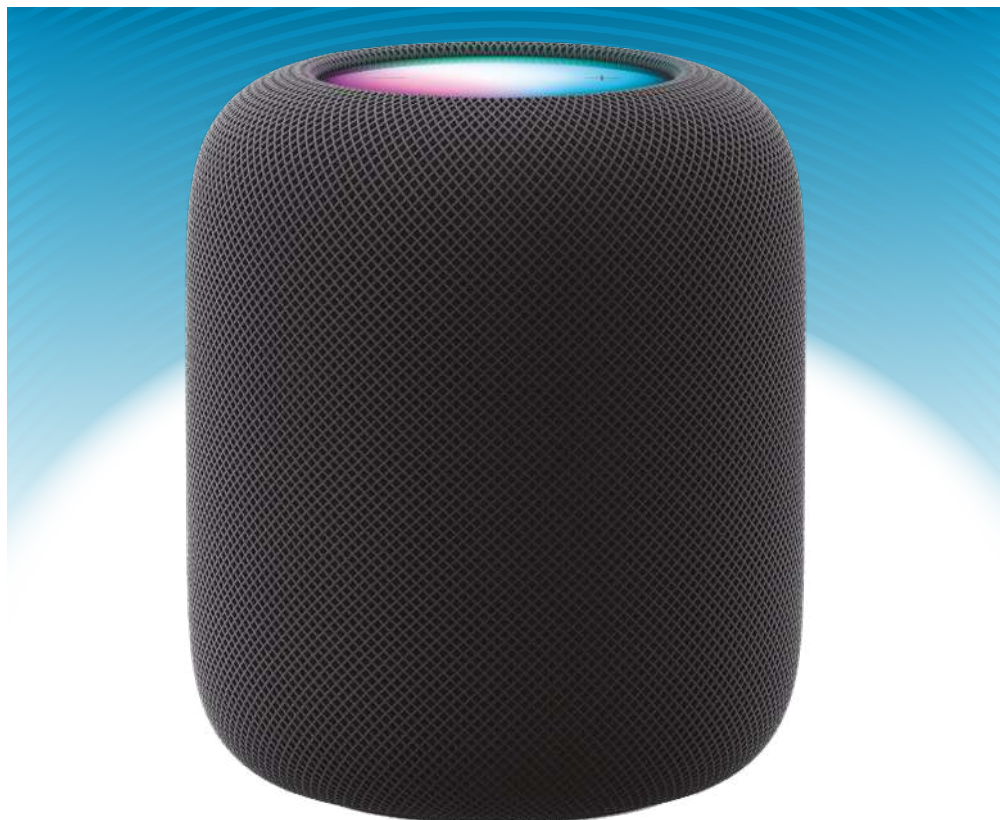
Luckily, it excels when it comes to audio quality. Apple has combined a four-inch, high-excursion woofer and a five-strong array of tweeters with a series of microphones and sensors that measure

ABOVE The minimalist design is as stylish as you'd expect from Apple



LEFT Setting up the HomePod is a piece of cake with an iPhone

BELOW You can set up two HomePods for stunning stereo sound



audio performance in real-time. This data is fed into Apple's S7 processor to continually tune the sound coming from the speakers to make sure it sounds great in the current environment. This works incredibly quickly, with retuning happening as soon as you move the speaker. More importantly, the results are epic.

Will the HomePod outperform a decent hi-fi? Maybe not, but the output is impressive for a single compact speaker. There's a sense of space and a clarity of detail you won't get from even the similarly sized Sonos Era 100, not to mention some surprisingly strong bass. It's great with pop, showing up subtle details in the mix of Dua Lipa's "Houdini", but is equally adept with classical, opera, 1970s rock and 1950s jazz. It's almost impossible to listen to anything on the HomePod without a smile on your face – even really miserable material from Radiohead. That goes double for tracks encoded with Dolby Atmos spatial audio, which, when done right, can sound breathtaking on the HomePod.

If you're an iPhone or iPad user, then, this is probably the best smart speaker for you. The Sonos Era 300 sounds just as spectacular in its own way, and has advantages if you'd rather work inside the more open Alexa ecosystem, but if you're happy with HomeKit and Apple's services, why look elsewhere?





Google Nest Audio

The top Google Assistant speaker, but the Nest Audio lags behind the best of other brands

SCORE ★★★★★

PRICE £74 (£89 inc VAT)
from [argos.co.uk](https://www.argos.co.uk)

Google's Nest Audio was lauded on its launch in 2020 for the way in which it improved on the weird design and underwhelming sound of the outgoing Google Home. Four years on, though, availability is stalling and Google's support is no longer what it was. Is it still worth investing in Google's smart speaker, or is it staring obsolescence in the face?

Well, there are still a lot of good things to say about Google's design. The slim, nicely rounded unit is quite compact at 124mm wide by 175mm high, and with a thickness of just 78mm you can cram it onto a narrow windowsill or shelf. There are no connectivity options and no physical controls bar a switch on the back that mutes the microphone. Instead, three touch surfaces on the top pick up taps to adjust the volume and pause or restart playback. Four coloured LEDs underneath the fabric surface give you visual feedback when you're talking to the Google Assistant or issuing commands.

It's very neat, tying with the Apple HomePod Mini as the most discreet and unobtrusive speaker in this test. And, thanks to Google's technology and services, it's also very useful. Queries and questions consistently bring informative responses trawled from popular resources on the web. Integration with Google Home also works a treat. While it doesn't have the Zigbee hub functionality of the Amazon Echo, it still works with a wide range of Wi-Fi devices and will control Zigbee devices through a Philips Hue or Ikea Tradfri hub. What's more, it supports the Matter protocol, and in practice adding a lightbulb through a QR code on the box was speedy and hassle-free through the Google Home app.

All the same, there are areas where the Nest Audio feels like it's going backwards. It can't offer directions or step-by-step recipes, or support the full range of skills and streaming services you'll find on the Alexa platform. We also found that it struggled to find some music tracks both on YouTube Music and Deezer, and occasionally played obscure live versions instead of the obvious originals.

When we want AC/DC's "Back in Black" we want the Bob Rock-produced studio version, thanks. What's more, the microphones are a little more prone to audio interference than we'd like, missing wake words with Radio 4 programmes running in the background at moderate levels, though music didn't cause any problems.

When you're listening to music through it, the Nest Audio sounds good if not quite outstanding. The sound is powerful despite the unit's

RIGHT Audio is quite powerful despite the device's diminutive form

ABOVE The Nest Audio integrates well with Google's tech

LEFT The compact design makes it easy to place the speaker on a narrow shelf

size, with plenty of headroom before the sound even gets close to breaking up. In terms of clarity and detail, we'd put it slightly above the standard Echo and close to the Sonos Era 100. However, there's something missing at the bottom end, and a tendency to muddle complex music in the mids, so that instruments smear together rather than find their own place in the mix. It's decent at reasonably low volumes and at its best at medium levels, but whack the volume up and it's slightly thin and tiring in direct comparison to the Echo, let alone the more expensive Apple and Sonos speakers.

There are rumours of new Nest Audio speakers that will incorporate Google's Gemini AI tech, and Google has confirmed that a Gemini-enhanced Google Assistant will be rolled out to existing products. With that in place and slightly better sounding hardware, the Nest Audio could come back in competitive form, and might even steal a march on the Echo and the HomePod. As it is right now, though, there's a sense that Google's speaker isn't quite keeping up with its rivals. It's the best Google Assistant speaker for under £100, but that isn't enough for us to recommend it.



JBL Authentics 300

The Authentics 300 is a superb retro-styled smart speaker, provided you love your bass

SCORE ★★★★★

PRICE £275 (£330 inc VAT)
from uk.jbl.com

Looking for a premium smart speaker with a dash of old-school style? The JBL Authentics 300 could be right up your street. It's the largest and most expensive model in the classic audio brand's Authentics range, combining two 25mm tweeters with a 5.25in woofer, a whopping 6.5in passive radiator firing downwards and 100W of power. And while it will work as a simple Bluetooth speaker, it also comes with Wi-Fi 6, Ethernet and Alexa and Google Assistant support built-in. In fact, it's the only speaker on test that supports both assistants at the same time. Just say "Alexa" or "Hey, Google" and it will wake the appropriate one.

The Authentics 300 is hard to ignore, with its retro faux-leather enclosure, gold finish trimmings and chunky carrying handle.

At 352 x 180 x 196mm and nearly 5kg in weight, you'll need a beefy shelf or table just to hold it, although it's perfectly comfortable on the floor. On the top you'll find one larger dial that controls the volume, plus two smaller inset dials that adjust the bass and treble. In between there are buttons for power and play/pause, plus a favourites button that will switch to EQ settings and a playlist you can set up in the accompanying JBL One app.

There are some really clever design touches here, such as the illuminated ring around the volume dial where the glowing segment grows as you turn the volume up. We also appreciate the way that the assistant LED glows white when you're talking to the Google Assistant and blue and cyan when you're talking to Alexa. The colour coding extends to notifications, and both assistants can be turned off with the microphone mute switch.

The Authentics 300 plays well with Alexa, giving you access to the same set of skills and capabilities. You can even add it to a group with Echo speakers and it will play the same music in tandem with them; a feat Sonos' speakers can't match. It will control both Google Home and Alexa devices, though it's

probably best to stick to the one ecosystem to avoid confusion and potential conflicts creeping in.

The usual queries, Echo-to-Echo calls and skills won't be a problem, either, with the Authentics 300 handling everything you'd expect from a standard Google or Alexa speaker.

In our tests, the Authentics 300's microphone array wasn't always as reliable as those on Amazon's speakers, missing the "Alexa" wake word with music or talk radio at medium to high volumes, though soft background music didn't cause a problem. Otherwise, it's a rock-solid smart speaker, and being able to switch between Google and Alexa can be handy, given that both have their own strengths and weaknesses.

ABOVE The retro Authentics 300 is big and hard to ignore



LEFT An internal battery allows you to lug the speaker away from the mains

BELOW The beefy, bass-heavy sound is ideal for high-energy pop and rock tracks



JBL certainly knows what it's doing when it comes to audio, and the Authentics 300 goes large on beefy sound with a strong mid-range, crisp trebles and a big dollop of bass. In fact, if anything, it's bass heavy, with a thumping low-end that works wonders on high-energy pop tracks and thick, overdriven guitars, but can sound over-egged on more intimate material, burying some of the detail.

You can tone things down with the bass and treble dials, or use the self-tuning feature to tailor the sound for your environment. Even then, though, we found it bass-heavy. You're either going to love the Authentics 300's sound signature or wish you had more of the Sonos Era 300's finesse.

Still, if the Authentics 300 isn't for everyone, we suspect that fans will love its final killer feature. Inside the unit sits a 4,800mAh battery, capable of powering it for up to eight hours. At moderate volumes we found that figure fairly accurate, with playback grinding to a halt after 7hrs 41mins. Meanwhile, the speaker charges back up to full in just over three hours. This arguably makes it the ultimate portable party smart speaker, even if neighbours/fellow campers/unlucky beach-goers will curse the day that JBL launched it.





Sonos Era 300

The best smart speaker you can buy for immersive audio, and well worth the premium price

SCORE ★★★★★

PRICE £314 (£377 inc VAT)
from johnlewis.com

The Sonos Era 300 is the premium model in the brand's Era range, priced at a whopping £449 inc VAT if you buy direct from Sonos, although we found it for far less at John Lewis.

There's no mistaking that this is a serious piece of audio kit. Measuring 260 x 160 x 185mm, it's the second largest speaker in this Labs, and at 4.5kg it's not much lighter than the mighty JBL Authentics 300, which has its own battery on board. There's something slightly odd about its shape, which has clearly been designed around the sound rather than the visual style. As a result, its looks are more divisive than the Apple HomePod or the Sonos Era 100.

The physical controls are capacitive and minimal, with play/pause, skip back and skip forward buttons on the top near the front, and a recessed volume slider just behind them. We generally found them responsive, but occasionally the play/pause button needed a second tap to register, or the volume slider went one too far in turning the volume up or down. There's also a microphone mute switch at the back, along with a Bluetooth button for pairing smartphones and tablets for some direct streaming. There's no physical line-in, but the USB-C port can host an adapter with Ethernet and 3.5mm sockets.

Like the Era 100, the Era 300 has support for Alexa built in, though you'll need to enable it through the Sonos app before it works. You can also control basic music and playback functions through Sonos' own more limited voice commands. Once enabled, Alexa works here much as it does on one of Amazon's own speakers, running the same Alexa skills and answering queries, and providing voice control for any



Wi-Fi devices or appliances you've connected to Alexa. Zigbee devices are off the menu, however, as the Era 300 doesn't have the Echo's built-in Zigbee hub.

Does the Era 300 make an effective smart speaker? Yes, although its dual microphone array isn't always as skilled as an Echo speaker at picking up wake words and voice commands, particularly with medium to loud background music or talk radio in play. In most normal scenarios it works fine, though, and we didn't note any odd delays in processing commands.

One thing the Era 300 won't do is work seamlessly with Echo speakers in a multiroom group. You could also argue that having to use Sonos' multiroom system brings complexity when adding music sources and getting everything up and running. However, it's worth the effort. The Sonos system is mature and tuned to controlling a sophisticated multiroom setup, with solid features for grouping speakers and stereo pairing, or directing different sources to play in different rooms. It also works with an enormous range of music-streaming services and podcast and radio sources, and gets easier once you've spent time in the UI.

ABOVE The Era 300's unusual design is likely to split opinion



LEFT The physical controls on the top are pretty minimal

BELOW The Era 300 is the best-sounding speaker in this Labs

Still, the only reason to pay this kind of money for a smart speaker is if you like the way it sounds, and it's near impossible to imagine anyone bar a serious hi-fi buff being unimpressed with the Era 300 on this count. Like the Apple HomePod, it supports Dolby Spatial Audio, and tracks that have been mixed well for this format sound spectacular, sometimes giving you the impression that you're in the studio as the track is being recorded. There's a real hi-fi sense of body and presence, with a powerful but articulate low end. Yet you can also hear the small details you'd usually only pick up on a decent pair of headphones, such as a plectrum squeaking on a string or a light harmony vocal.

The Era 300 doesn't falter on normal stereo material, still sounding better than any other speaker in this Labs – including Apple's awesome HomePod. It doesn't have the latter's real-time computational audio tuning, but Sonos's Trueplay tuning does a great job of tailoring the sound for your specific room. And while it's at its best at medium to high volumes, the output still scales down well to work at lower levels. Where the JBL's bass will wake up the whole family at night, the Era 300 can still sound good even when it's running quiet.

If you've got the budget and your focus is on music, the only way to beat the Era 300 is by buying two for a stereo pair.



Alexa vs Google vs Siri: just how smart are they?

Speaker, speaker, near the wall, who's the smartest of them all?
We find out in our battle of the virtual assistants

Smart speakers aren't just about music playback; we want them to answer questions, update us on news and weather, and give us instant access to information without digging out our phones. This all comes down to the installed virtual assistant, and the features they support. So, who's the smartest these days? Is it Apple's Siri, Amazon's Alexa or Google's more anonymous assistant? We put all three to the test to find out.

Local info

When asked to find the nearest supermarket, only Siri came back with strong info, covering each of the local mini-markets and superstores in order of distance, and providing positive ratings and opening hours. Alexa informed us of a local mini-market that has actually been a carpet shop for the past five years, and could only give us the two largest supermarkets in town when asked for them specifically by name. Google's response was just weird, giving us the location of the giant Tesco on the edge of town, but ignoring the significantly closer Aldi. It could also inform us of a Waitrose in the next large town, but not the Lidl that's slightly nearer. Is Google some kind of supermarket snob?

WINNER Siri

DUNCE CAP Alexa

Eating in

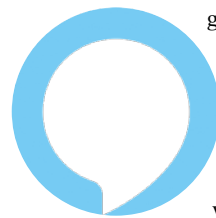
We requested recipes for chocolate brownies. Siri told us that she'd found some web results and would send them to an iPhone. Nothing arrived. We repeated our request and were told to ask again from the iPhone. The Google Assistant promised us recipes, but no actual recipes were forthcoming. It appears this is a deprecated feature. That leaves Alexa. Amazon's assistant not only came back with a choice of recipes, but could actually take us through them step by step with clear instructions.

WINNER Alexa

DUNCE CAP Siri and Google

Eating out

We asked whether we should go to a local restaurant, and then for a recommendation of the best Indian restaurant in the nearest city. Amazon



did relatively poorly here, first giving us a review of a completely different restaurant in a different town (we asked twice to eliminate user error), then a list of three Indian restaurants with their locations, but no ideas about their quality. Google wasn't any better, telling us it wasn't clear if the local restaurant did takeaway, then just listing three restaurants with no details whatsoever. Follow-up questions about these restaurants drew a blank response. Siri gave the best advice here. It still struggled to provide useful info on the local restaurant, but did give us ratings for an Indian restaurant, and the opportunity to hear more about others further down its rankings.

WINNER Siri

DUNCE CAP Amazon and Google

Entertainment

We asked if we could see *Alien: Romulus* tomorrow in our nearest city. Siri wasn't keen. She had found some web results but would only reveal them if asked again from an iPhone. Alexa was even less helpful, replying that she didn't know or didn't have an answer for the question. That left Google, and the able Assistant not only knew which cinema it was playing in, but the times as well. In fact, it knew two other cinemas where it was showing and the times they were playing it!

WINNER Google

DUNCE CAP Siri and Alexa

Weather

This is one area where all three assistants do exactly what you'd hope they'd do. We asked what the weather would be like tomorrow, and Siri instantly rewarded us with a brief weather summary with details of the

general conditions and information on the daytime and overnight temperatures. The Google Assistant and Alexa gave less detail, but still the general weather conditions through the day with high and low temperatures.

WINNER Siri

DUNCE CAP No-one

General knowledge

Here we asked questions covering British history, American politics (nothing controversial), simple arithmetic and foreign languages. On the latter, all three assistants came up trumps, providing us with the test phrase translated clearly in the correct accent. Arithmetic wasn't a problem, either. Simple sums and square root questions were answered almost instantly. On British history, Siri, Alexa and Google all provided answers along with basic info, but

Google provided more context and detail. On American politics, Siri successfully sent info to an iPhone, but gave us nothing through the speaker. Alexa provided solid but very basic

information, and Google once again provided useful and relevant info that went slightly more in-depth.

WINNER Google

DUNCE CAP No-one

Tech buying advice

Obviously it's not in our interest for these smart speakers to give too much in the way of tech guidance or buying advice. Luckily, they weren't much cop. Asked to recommend a gaming headset for the Xbox Series X, Siri once again boasted that she'd found some web results and would show them to us if we asked from an iPhone. Alexa was just annoying, first asking if we'd like to shop for said headset on

Amazon, then recommending we buy an Xbox Series X, forgetting the headset bit altogether. Only Google was at all useful, providing two reasonable recommendations from TechRadar.

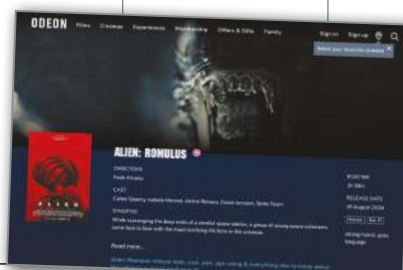
WINNER Google

DUNCE CAP Siri and Alexa

ABOVE All three assistants coped well with basics such as a weather forecast

"It's not in our interest for these smart speakers to give too much in the way of tech guidance. Luckily, they weren't much cop"

BELOW Google Assistant was the winner when it came to a local cinema guide



The smart display alternative

Why stick to only audio when you can have visuals and a touchscreen as well?
We test all the main options to discover the best

Smart displays lack the music playback chops of the best smart speakers, but they arguably provide a more efficient and accessible way to control your smart home, not to mention adding video playback, video calling and digital photo frame capabilities. They also slot into the same Google and Amazon ecosystems as their smart speaker siblings, making them an easy addition to your main speakers.

Apple has steered clear of smart displays so far, with the area now completely dominated by Amazon. It manufactures its Echo Show in four different sizes, although the largest Echo Show 15 was unavailable at the time of writing; it's either been discontinued or is about to be replaced. Such is the unpredictability of this market. Meanwhile, Google still sells its 7in Echo Nest Hub, along with the larger 10in Nest Hub Max.

AMAZON ECHO SHOW 5

SCORE ★★★★★

PRICE £75 (£90 inc VAT)
from amazon.co.uk

The Echo Show has the role of the Echo Dot in the Echo Show lineup, providing a cheap and cheerful entry point into Amazon's smart displays. This means making

do with a 5.5in, 960 x 480 resolution screen and a basic 2MP camera.

The screen's image quality is adequate, but at this size it makes a better bedside alarm clock and smart photo frame than something you'd use to watch Netflix or Amazon Prime Video. Luckily, the low minimum brightness level means you can do just that, and it's fine for checking visitors at the door on your Ring doorbell camera or quickly adjusting your smart lighting.

Inside the wedge-shaped profile there's a single 1.75in speaker, which produces sound on a par with the Echo Pop, though not the fifth generation Echo Dot. Overall, this smart display has its place as a basic option for smart home control and everyday Alexa interactions, but if you want to do more than that you're better off investing in the larger Echo Show 8.

AMAZON ECHO SHOW 8 (THIRD GEN)

SCORE ★★★★★

PRICE £125 (£150 inc VAT)
from amazon.co.uk



The third-generation Echo Show 8 is easily the best of the smaller Echo Shows, thanks to a faster processor, an upgraded camera, more powerful speakers and a slick design. Amazon has also integrated



ABOVE The Echo Show 8 is a highly versatile device

Fire TV features into this mid-sized smart display, giving you instant access from the homescreen to a wide range of streaming services that are all more watchable on the 8in, 1,280 x 800 screen.

The updated Show 8 packs two 2in stereo speakers along with a passive radiator and support for spatial audio, so it's more enjoyable to listen to as well. It's not up there with the full-sized Echo, but it has a warm sound and decent levels of bass.

Throw in video calls with automatic pan and zoom tracking, making the most of the 13MP camera, and you have a more versatile smart display all round. Plus, with a mute switch and a privacy shutter, there's no need to worry

"The third-generation Echo Show 8 has a faster processor, an upgraded camera, more powerful speakers and a slick design"

about being snooped on.

Factor in the built-in Zigbee, Thread Border and Matter hub, and this is easily the best smart display for the majority of people.

AMAZON ECHO SHOW 10 (THIRD GEN)

SCORE ★★★★★

PRICE £217 (£260 inc VAT)
from amazon.co.uk

Amazons's supersized Echo Show speaker is best known for its unique party trick: a 10in screen that can rotate around the central speaker barrel to follow you around the room. It sounds creepy, but the motion tracking is very effective, and it's



LEFT The Echo Show 5 is a cheap and cheerful smart display

perfect for following recipes or watching video as you, say, wander around the kitchen. It's also useful for video calls, so long as you remember that your face might still be visible when you try to wander out of frame. Watch those eyerolls.

The resolution remains stuck at 1,280 x 800 and won't beat a budget tablet on quality, but it's perfectly adequate for watching shows on Netflix or Amazon Prime Video if you're not too fussed about optimal image quality. Meanwhile, the dual 1in tweeters and 3in woofer deliver the best audio of any current smart display.

It's significantly more expensive than the already brilliant Echo Show 8, though, so much depends on how much you're willing to spend for a premium model with a nifty gimmick, a slightly bigger image and better sound. You'll also need more space on your shelf or kitchen surface for the rotating screen to do its stuff.

GOOGLE NEST HUB (SECOND GEN)

SCORE ★★★★★

PRICE £75 (£90 inc VAT)
from store.google.com



Like Amazon's Echo Show smart displays, the Google Nest Hub works as a touchscreen interface for your smart home, a video and audio player, and a digital photo frame. It can also make a great bedside alarm clock, with the bonus (you could argue) that there's no onboard camera for video calls to give you any privacy concerns.



ABOVE The display on the Echo Show 10 can rotate to follow you around the room

You can even disable the microphone with a flick of a switch on the rear. However, doing so disables one of the Nest Hub's most interesting features: sleep tracking to let you know how long and well you sleep at night. It works using the microphone and a specialist Soli radar sensor, and provides detailed and useful information. Just be aware that at some point this will only be available to Fitbit Premium subscribers, at a cost of £7.99 per month or £79.99 per year.

It's not the only trick the Nest Hub has up its sleeve. The CPU now handles some of the speech recognition workloads, rather than sending them for decoding on a remote server, and that means speedier responses to many queries. Integration with Google Maps, Google Calendar, Google Photos and YouTube works extremely well, and you can also watch Netflix or Disney+ with a subscription.

Matter and Thread support makes the Nest Hub a viable smart home hub as well, while the speakers are fine for radio and casual listening at low to medium volumes. You'll want a bigger, higher-resolution screen if you spend much time watching video, but this is a fine entry-level smart display.

GOOGLE NEST HUB MAX

SCORE ★★★★★

PRICE £183 (£219 inc VAT)
from store.google.com

The Nest Hub Max lacks the sleep-tracking features of the smaller Nest Hub, but there's more to it than just a bigger screen. It looks like a tablet perched on a fabric-covered stand, with a 10in, 1,280 x 800 resolution display that looks great when you're watching YouTube videos, with the colour and brightness adjusting automatically to match conditions in the room. The two 18mm tweeters and 75mm woofer



ABOVE The Nest Hub Max can be controlled by hand gestures

produce a surprisingly powerful sound, with a booming bass and clear high and mid-range output.

With the camera turned on, gesture controls enable you to play and pause music or videos with a raise of a hand. The camera also powers the Face Match tech, which identifies you from an initial head scan, then greets you with missed messages, travel info and calendar events.

You can also make video calls using Google Meet, with the camera tracking your movements to keep you in the frame, though the unit itself doesn't actually move. It's a shame, however, that Google has removed the feature to make video intercom calls between units housed in different rooms.

With Nest Aware security features and a Thread and Matter hub, this is Google's most fully featured smart display, but it falls short of an award as it costs more than even Amazon's high-end Echo Show 10.

LEFT Google's Nest Hub can track your sleep patterns





Amazon Echo Dot (fifth generation)

The smartest small speaker, though not the best for audio

SCORE ★★★★★

PRICE £46 (£55 inc VAT)
from amazon.co.uk

It's no longer the entry-level Echo, but the Echo Dot still makes a great low-cost alternative to the full-sized version, or simply as an addition to your Echo system. The fifth iteration looks like a scaled-down fourth-gen Echo, and comes in a choice of black, white and blue finishes, but it has extra features tucked away.

Perhaps the cleverest are ultrasonic motion sensors, to sense when a room is occupied, and a temperature sensor. You can use these to trigger routines to turn the heating on as the temperature falls or drop the lighting if a room is empty. It makes it all the more tempting for keen home automators to have Echo Dots scattered all around the house.



The Echo Dot also doubles as a 100Mbps/sec Wi-Fi mesh extender if you have an Amazon Eero router, and you can now tap on the sphere to snooze alarms, toggle pause and play or end a voice call. You still have physical volume buttons and a microphone mute, plus the action button to wake Alexa or turn off an alarm.

RIGHT The Echo Dot is available in white, black and blue finishes



LEFT Motion and temperature sensors make the Echo Dot a great choice for home automators

When it comes to voice commands, the Echo Dot performs consistently well. We had no issues finding and playing music, turning smart light bulbs on and off or getting answers to questions, within Alexa's limitations. Requests from outside the room weren't a problem, and the Dot's microphone array didn't fumble commands when hit with background music or Radio 4 playing in the same room.

As for the audio quality, a larger 1.73mm speaker, firing forwards at a slightly upwards angle, makes this the best-sounding Echo Dot yet. It can't go toe to toe with the Apple HomePod Mini, and the sound grows boxy and congested at higher volumes, but at lower levels the tone is surprisingly warm and well rounded, and fine for

background music or radio. And you always have the option of using it in a stereo pair.

Go for the Echo or the HomePod Mini if you're looking for better sound, but the Echo Dot is the smartest speaker you can buy for under £60 – and we've seen it for £30 in Amazon's frequent sales.

Amazon Echo Pop

An effective mini-Echo that's perfect for expanding your system

SCORE ★★★★★

PRICE £37 (£45 inc VAT)
from amazon.co.uk

The Echo Pop creeps under the Echo Dot as Amazon's entry-level smart speaker, giving you the bare essentials in an even smaller speaker. In fact, it looks a little like someone has sliced a Dot in half, leaving a flat front, angled upwards, with a shorter light bar at the top. Behind that you'll find the Pop's physical controls, now limited to volume up and down and a mute for the trio of onboard microphones. It's available in four fun colours, and you can even accessorise the speaker with a range of coloured jackets. It's the ideal Echo for a kid's bedroom or to brighten a dull corner of the house.

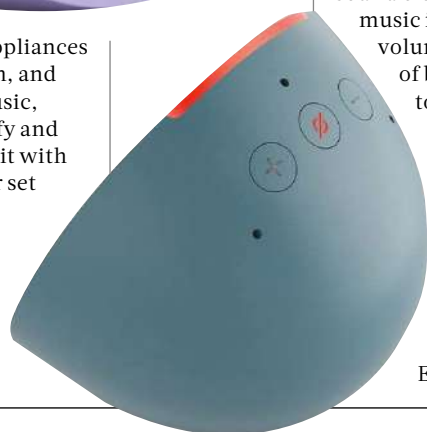
Despite its tiny stature, the Pop does pretty much the same stuff as the Dot. It will answer questions,



control smart devices and appliances within your Alexa ecosystem, and play music from Amazon Music, Deezer, TuneIn, Rayo, Spotify and Apple Music. You can group it with your other Echo speakers, or set up two Pops as a stereo pair.

So what do you lose? Physically, you lose the Dot's tap controls, but

RIGHT The Pop's physical controls are limited to volume and mute



LEFT The tiny, brightly coloured Echo Pop is ideal for a child's bedroom

arguably the bigger losses are its big brother's temperature and motion sensors. You also lose support for Eero mesh networking, so this can't act as a Wi-Fi extender.

In terms of performance, we found the Pop just as sensitive to voice controls as the other Echo speakers. It had no issues recognising its wake word from a decent range, even understanding questions. Even background music and spoken word radio didn't put it off. And while the sound is a step down from the Dot, it's far from unlistenable. It's great for radio, audiobooks and podcasts, as voices sound clear and authoritative. Even music isn't bad at low to medium volumes, despite a general lack of bass and a slightly boxy tone. Push the volume up too far, though, and the sound grows harsh and rapidly breaks up.

Despite having a smaller driver, the Echo Dot remains the superior small smart speaker, but if you're looking for a cheap extra Echo the Pop fits the bill.

Apple HomePod Mini

The best-sounding small speaker, but it falls behind rivals for versatility

SCORE ★★★★★
PRICE £83 (£99 inc VAT)
from apple.com/uk

Apple's smaller HomePod is a fantastic piece of engineering, giving you most of the HomePod's tech and features in a tiny package at a lower price. It's a 98mm diameter sphere with the top and bottom chopped off, with the plate at the top housing a multicoloured light display and the bottom a non-slip foot. The display doubles as a control surface, operating through taps to play, pause and skip, wake Siri or adjust the volume.

The HomePod Mini comes in five colours and looks stylish almost anywhere you put it. More importantly, it sounds incredible. Apple has combined a full-range driver with two passive radiators to make sure you get both stellar clarity and low-end weight, and the



output is louder, richer and more spacious than you might believe. It uses the same computational audio and real-time tuning tech as the bigger HomePod, with the same results. From the Beatles and Charles Mingus to Dua Lipa and Shostakovich, there wasn't anything we tried on the HomePod Mini that didn't

RIGHT You'll need an iPhone or an iPad to get the best out of the HomePod Mini



LEFT The HomePod Mini is a fantastic piece of engineering – and it sounds great, too

sound good. In fact, we had to keep looking at the speaker sat behind us to make sure it hadn't been switched.

The HomePod also recognised voice commands well, not even getting foiled by background music or talk radio blaring in the room. What's more, with built-in temperature and humidity sensors, it can play a useful role in triggering HomeKit routines.

Still, the HomePod Mini isn't perfect. Voice commands through HomeKit and the iOS Home app work perfectly well, but with a more limited range of hardware. And while you can play other music sources through the Mini via AirPlay, compared to Echos it supports a small range of services as default music services – and you can't play BBC radio except from the BBC Sounds app through AirPlay.

Meanwhile, the HomePod Mini's value as a smart speaker is undercut by its tendency to not answer questions, but suggest you ask again using Siri on your phone. For our money, this is the best-sounding smart speaker for under £100. It's just a shame it can be so dependent on you having an iPhone or iPad in reach.

Google Nest Mini 2

A viable cheap Google option, but far from the best small smart speaker

SCORE ★★★★★
PRICE £41 (£49 inc VAT)
from store.google.com

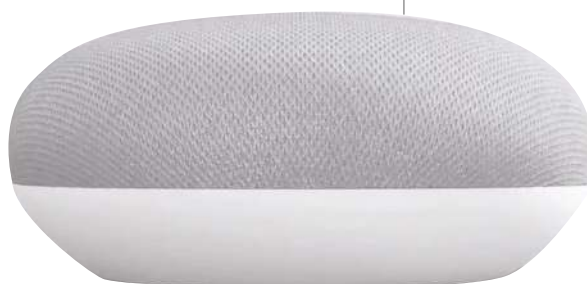
The Nest Mini 2 plays the same role in Google's ecosystem as the Echo Pop and Echo Dot in Amazon's. It's not the speaker you'll want for serious music listening, but it's a cheap entry point for people wanting to try out voice control, and it's good enough for radio or background music when you're not bothered about hi-fi sound.

The sense that it's "good enough" is probably why Google hasn't updated the Mini in the past five years (and no, that isn't a typo). There are no unsightly buttons here, just a puck-shaped device with four LEDs beneath a fabric cover, with embedded touch controls to play



and pause, stop alarms, and turn the volume up or down. Nor do you get wired connectivity beyond the power input, which connects to the supplied wall wart adapter, while there's a single switch on the bottom to enable or disable the microphone.

ABOVE The Nest Mini 2 hasn't been updated for a full five years



RIGHT There are no unsightly buttons to disturb the Nest Mini 2's clean lines

Compared to the Echo Dot or Apple HomePod Mini with their embedded sensors, it's running low on features.

The Nest Mini 2 covers most of the same ground as the Nest Audio. You can ask questions, play music, podcasts and audiobooks, and control any smart devices and appliances you have connected up through Google Home. A software update means it now supports Matter devices, and voice commands work well. We had one moment during testing where the Nest Mini 2 twice failed to recognise the "OK, Google" wake word over spoken word radio, but this was the exception rather than the norm.

The Mini 2 is a decent cheap option if you want to use Google's ecosystem, but it has two problems. First, that ecosystem has lost some of its capabilities, and while it often delivers good responses to spoken questions, it simply doesn't do everything that Alexa can. Meanwhile, the Echo Dot, Echo Pop and HomePod Mini have upped the ante on audio quality, and now sound noticeably better than the Nest Mini 2, where there's precious little at the low end to drive your music forward. If you're not already wedded to Google's services, we suggest looking at Amazon's speakers instead.



Sonos Era 100

A superb smart speaker for music, though not the best all-rounder

SCORE ★★★★★

PRICE £166 (£199 inc VAT)
from sonos.com

If you're more concerned with how your speaker sounds than its "smarts", the Sonos Era 100 is as good as it gets for £200. Packed with three class-D amplifiers, two angled tweeters and a large mid-woofer, it produces a smoother, better-balanced and arguably more hi-fi-like audio than any similarly sized rival bar the Apple HomePod. Pop and rock sound fantastic, with a driving bass, a wide soundstage and plenty of high-end detail. Play small group jazz or more intimate acoustic music, and there's a warmth and clarity that brings the tracks to life. What's more, Sonos' clever Trueplay does a fine job of tuning the sound for your specific environment to get the best results.

The physical design is slick and practical, with capacitive controls



on the top of the speaker, and the mains cable connecting through a recessed socket in the base, so that you can have the unit flat on a shelf but close to a wall. There's also a USB-C port, which can be used to connect an Ethernet and auxiliary line-in adapter. It's just a shame it costs an extra £39.

RIGHT Capacitive controls on the top let you play, pause and adjust volume



LEFT It may not be the smartest smart speaker, but its audio output is up there with the best

As with the Era 300, buying the Era means buying into the Sonos ecosystem. The Era 100 supports Alexa, but you need to enable it in the Sonos app. And while it will answer questions and control Alexa-compatible appliances or lighting, it has the same voice command foibles as its larger sibling. It doesn't have the Zigbee hub features of the Echo or the temperature sensor of the Dot, and while you can add an Era 100 to an Alexa group, you can't have the same music playing through Sonos and Echo speakers at the same time. In command tests, the Era 100 was also easier to bamboozle than any Echo speaker with loud background music or talk radio.

Still, if you already own Sonos speakers, you'll be adding into one of the most well-thought-out and flexible multiroom audio systems around, with voice support for most major music-streaming services, and access to a wide range of others once linked through the app. This isn't the best all-round smart speaker, then, but a brilliant entry-point into a superb audio system.

Xiaomi Smart Speaker IR Control

Lots of features for a cheap speaker, but unfortunately the sound reflects the price

SCORE ★★★★★

PRICE £25 (£30 inc VAT)
from mi.com

Xiaomi's smart speaker is the cheapest here, yet it still packs in the Google Assistant and more features than the Google Nest Hub Mini 2 or Echo Pop. It's a rectangular tower of plastic 14cm high, with a digital clock display on the front near the top and a four-way circular control ring surrounding a single glowing spot on the top panel. The ring clicks left and right to decrease and increase the volume, while pressing down handles pause/play and up mutes the microphone.

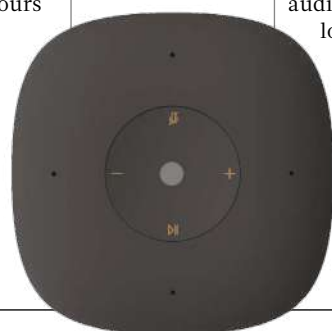
With the clock display, the Smart Speaker can moonlight as a bedside alarm clock, and you can set alarms through Google Assistant. Don't worry about being kept awake by the display;



you can dim the brightness and lower the maximum volume at night hours through the Google Home app.

In case you were wondering about the IR Control part of its name, the speaker houses an onboard IR transmitter you can use to control certain devices and appliances direct

RIGHT The controls are positioned in a glowing circle on the top of the device



LEFT The 14cm-tall Xiaomi speaker can double up as an alarm clock thanks to its digital display

through voice control. However, it only works with a tiny line-up of TVs, fans, projectors and air conditioners.

In other respects, the Xiaomi is similar to the Nest Hub Mini 2, taking voice commands and queries like any other Google speaker. The audio dims and the spot at the top glows when it's waiting for your commands, and the two onboard microphones do a solid job of recognising the "OK Google" wake words both up close and at a distance. Only with Radio 4 blaring out in the same room did we manage to wrong-foot it. However, we did find it slow to activate smart light bulbs or change colour and brightness settings, as if it needed a quick pause for thought.

You can't have it all for £30, and the Smart Speaker falls short on audio. It actually goes substantially louder and has more presence than the Nest Mini 2, but there's not much bass and the tone is thin. Whack up the volume anywhere near full and the case starts to resonate. The Amazon Echo Pop is smaller and no better on the bass front, but puts out a richer and more open sound.

View from the Labs

While smart speakers have matured in many ways, they have also become less intelligent – which makes Stuart wonder if there's an unpleasant paid-for surprise round the corner

I had my share of wow moments while testing the speakers in this month's Labs. First the HomePod Mini baffled me by producing big sounds from a tiny sphere, to the point where I genuinely looked around for the "real" speaker. Then the biggest HomePod went one better, delivering a fantastic, open, room-filling noise with fantastic detail from what's still a very compact single unit. When it comes to making noise, Apple knows what it's doing.

I was also pleased to see a product that wasn't made by one of the world's biggest technology brands – until, that is, I realised that JBL is now a Harman International brand, and Harman is a subsidiary of Samsung. More to the point, JBL's Authentics 300 produces an incredibly powerful sound with a bass that can dial up to the kind of chest-shaking levels normally only heard in nightclubs and the cars of boy racers. And who can resist its retro looks?

Best of all was the Sonos Era 300. Once you've heard it tackling immersive Dolby Atmos audio, it's all too tempting to waste a whole afternoon running through other tracks. Its performance in standard stereo tracks is also a thing of wonder.

Yet other aspects of this Labs have left me feeling more depressed than impressed. I was hoping that smart speakers would be gaining capabilities, but in some cases they're



Stuart Andrews is a former reviews editor of PC Pro



ABOVE Smart speakers are sounding better than ever before, but they're also doing less

losing them. Google has dropped a bunch of features from the Nest Mini 2 and Nest Audio in order, the company claims, to focus on those features its users love and use the most.

"Maybe AI will be the catalyst that takes smart speakers to a whole new level and gives me a bunch of different wow moments"

Meanwhile, HomePod's Siri virtual assistant is a shadow of the one you'll find in your pocket, and now bats queries back with the advice to ask again from your iPhone.

Then there's Alexa.

She has a wide range of capabilities and a fantastic library of skills, but as I discovered when putting her smarts to the test (see p89), she lacks the local and in-depth knowledge that you'll find from Siri or Google.

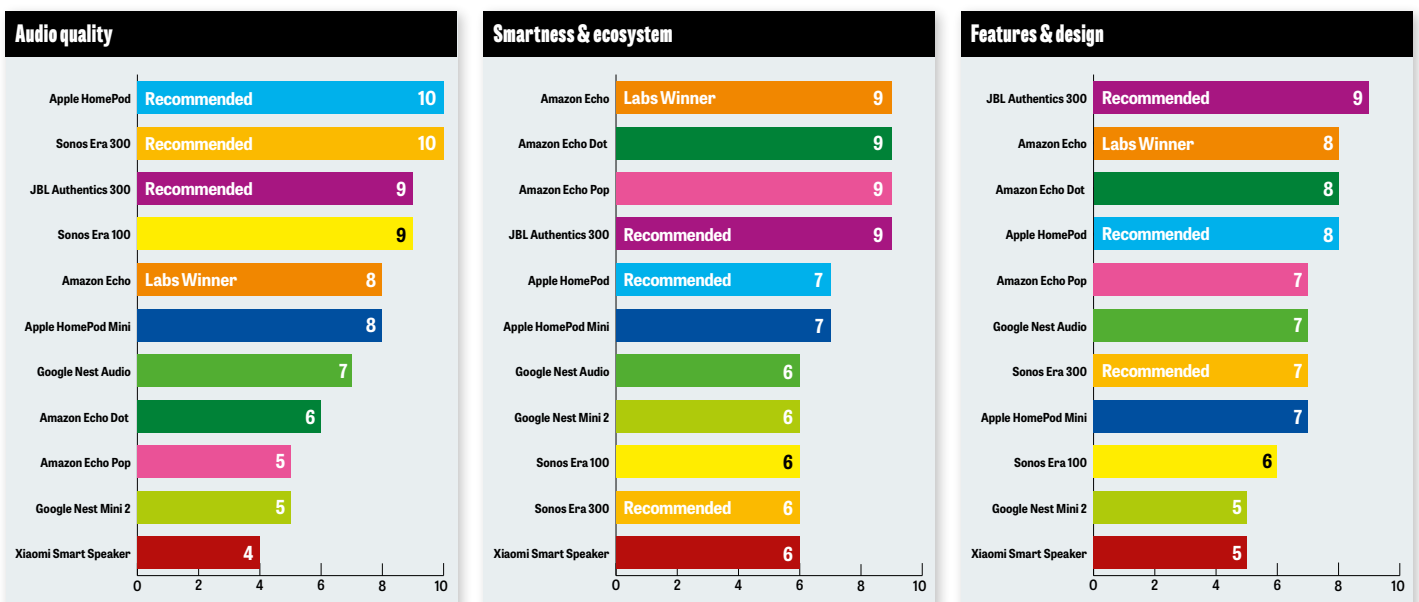
I was left wondering if we're just waiting in limbo before AI comes in to transform the smart speaker market. Google is already talking about

integrating its Gemini AI into the Google Assistant and Nest Audio products, just as it's doing with its Pixel phones. At the time of writing, rumours abound of a paid, premium version of Alexa, using AI to provide more relevant information and more useful guidance, applying its improved intelligence to all the data that Amazon already holds. Siri also looks set to be enhanced with the aid of more conversational AI capabilities.

It might just be another example of overworked AI hype, but maybe AI will be the catalyst that takes smart speakers to a whole new level and gives me a bunch of different wow moments the next time we dedicate a Labs to smart speakers. Although I fear my jaw will only truly drop when I see the monthly subscription prices the companies will demand to access its full intelligence. ●

Test results

Rating out of ten (subjective scores)



The Network

Practical buying and strategic advice for IT managers and decision makers

Buyer's guide

On-premises business backup

Put your data at risk and you're putting your business at risk. **Dave Mitchell** explains how to put safeguards in place and what backup products can help

Data backup is a fundamental part of a business protection and continuity strategy and SMBs that don't implement such safeguards this are taking some dreadful risks. The value of data can't be overestimated: it's the only business asset that isn't expendable. Once it's gone, it's gone for good.

Today's bleak threat landscape makes it even more important for businesses to secure their data. An accidentally deleted file may be an inconvenience, but SMBs need to protect themselves against a raft of major incidents, including data breaches, ransomware attacks, severe weather events, fire, floods and equipment theft.

This cavalier attitude can't be due to lack of choice as there are plenty of good quality backup products on the market that cover all business environments and budgets. In fact, the biggest hurdle facing SMBs today is the sheer range of solutions, so it's extremely important to pick the one that fits their data protection requirements best to avoid inadequate recovery procedures.

This month, we look at backup products designed to be run on-premises and test software solutions from four established names – Arcserve, Iperius, Nakivo and Veritas. These are very affordable options for SMBs, and we've put them through their paces in the lab to help you make the right choice.

Backup in the house

On-premises backup software offers a number of advantages over cloud-based solutions. You don't

BELOW Arcserve's UDP software can be managed from a cloud portal

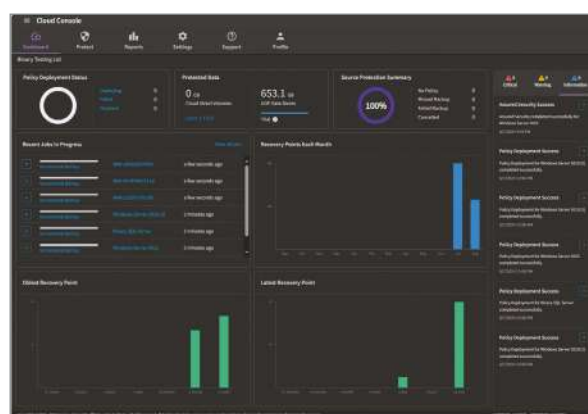
need an internet connection to access data for recovery purposes and, as it's stored at an in-house primary location, you have total control over access security.

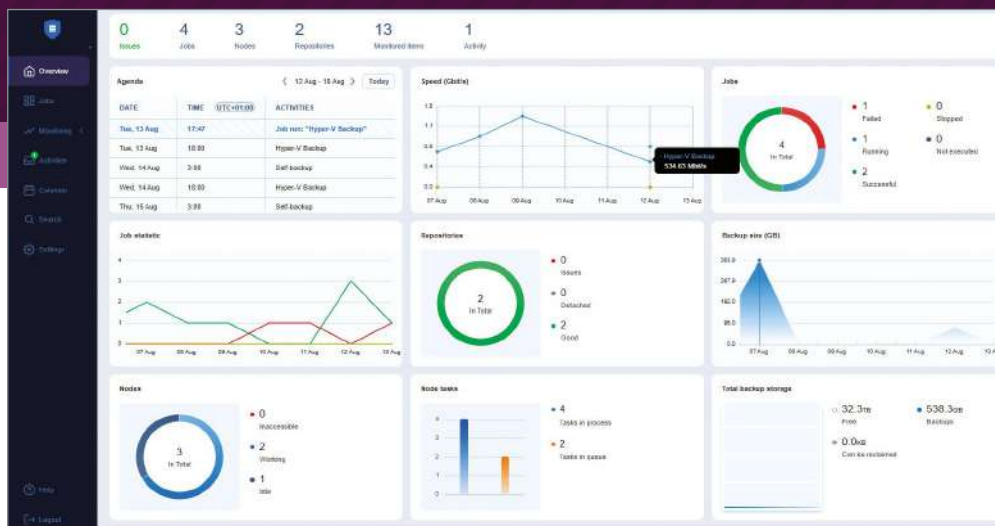
The initial expenditure will be higher than cloud services, but you won't need to factor in monthly or yearly storage subscription fees so ongoing costs will be much lower. You can customise the host hardware to your requirements and any configuration changes, upgrades and software updates can be run at your discretion and at times of your choosing.

Naturally, up-front expenditure is necessary as a host system will be required to run the software. For our lab tests, we use Synology NAS appliances and Dell PowerEdge servers, which are affordable options for SMBs and can be easily upgraded to keep in step with backup storage demands.

Cloud cover

Going down the on-premises route doesn't mean cloud storage is off the agenda. Far from it, as cloud





providers can play an essential role in a backup strategy.

Known as hybrid backup, the most common strategy for reliable data protection is “3-2-1”, where you retain three up-to-date copies of your data, back it up to two different types of storage media and keep one copy off-site. This insures against most threats as onsite backups provide fast recovery services for lost or deleted items while off-site backups have you covered for disasters such as theft or fire.

These strategies are easy to manage, as good backup products can do it all for you. Look for those that support a feature called staging, as this allows you to create a single job that backs up data to local storage and automatically follows it with a second phase that copies the data to an off-site location.

You'll also have a much wider choice for backup locations. All four products in this guide are able to use local and network shared storage, NAS appliances or IP SANs, and augment these with support for

cloud providers including Amazon S3 and Microsoft Azure.

This is one of the main reasons we recommend using a single backup product to protect all your systems and applications. Multiple products are an unnecessary expense, and the increase in management overheads could easily result in data failing to be backed up correctly.

Ransomware protection

Ransomware attacks are on the increase, and no business should think it is too small to be of interest to cybercriminals. Backup software can't protect against these threats but it has a number of features that

will help you mitigate them.

Look for those products that offer recovery points and file versioning, as these allow you to retain multiple copies of files going back days, weeks and even months. If you get caught by a ransomware demand, it may

ABOVE Nakivo's software can be hosted on a range of NAS appliances

LEFT Nakivo adds protection against ransomware with immutable recovery points

be possible to browse your backups and restore files to the state they were in before they were encrypted.

The more devious ransomware attacks attempt to breach the backup system and delete all backups prior to encrypting your primary data. Immutable storage is a great defence as, once written to, it can't be changed, overwritten or deleted. If you've chosen a backup product that supports cloud storage, immutable storage is yours for the asking.

Amazon, for example, offers S3 Object Lock, which turns cloud buckets into WORM (write once, read many) devices so they can't be modified or deleted until the set retention period has expired. Use these and you'll be creating a “3-2-1-1” strategy, where the fourth step is backing up to immutable cloud storage.

Leave nothing to chance

Give yourself a well-earned pat on the back when your data protection strategy is up and running, but don't relax yet as you must test all restore facilities. A surprisingly common problem is finding out your backups weren't completing properly only when you need to recover data.

Make sure you set the backup software to provide alert notifications by email or SMS. If you receive warnings that a backup job has failed, check the logs, find out what the

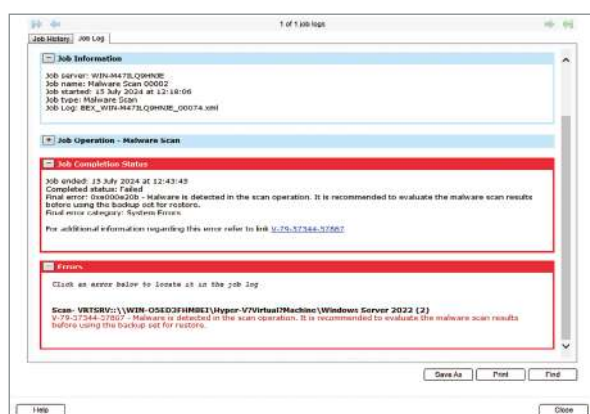
problem is and fix it immediately.

Contingency planning involves regular testing to ensure your backups are working and all unforeseen problems are ironed out before you need to use them when a real disaster strikes. Do this and you've just created a 3-2-1-1-0 strategy, which requires all standard copies of data maintained in different locations, additional immutable storage and zero errors for all your recovery processes.

It's essential to choose the right backup software for your environment, and all four products in this guide are available as free time-limited trials so you can try them out before buying. Data loss can have catastrophic consequences for an SMB, so read on to see which backup product will keep your business safe.

“A surprisingly common problem is finding out your backups weren't completing properly only when you need to recover data”

LEFT Prior to restoring data, Backup Exec scans files for malware





Arcserve UDP 10

A top data protection choice for physical and virtual environments with smart cloud management

SCORE ★★★★★

PRICE Premium, 1 socket, £1,257 exc VAT from arcserve.com

Arcserve UDP (unified data protection) is a versatile backup and recovery solution designed from the ground up to protect physical and virtualised environments. It will please businesses that want a choice of deployment options as it's available in a range of turnkey 9000-series rack appliances, the software can be installed on your choice of on-premises hardware, and it can be managed locally or in the cloud.

UDP 10 adds valuable new features including malware scanning and a redesigned cloud console. It's available in a range of licensing schemes, and the price we've shown is for the UDP 10 software with a single socket premium licence that has no restrictions on the amount of back-end storage and supports unlimited virtual machines (VMs).

We installed UDP 10 on a Dell PowerEdge R760xs rack server running Windows Server 2022. If you want to host it fully on-premises, you select the local management console option. We were testing cloud management, so we left this unticked and installed the UDP gateway component on a separate Windows host.

From the UDP cloud portal, we could see the gateway was online and linked to our account so we just needed to declare our host as a new

recovery point server (RPS). The RPS defines where data is backed up to, and you can use any storage on the UDP host along with other networked Windows Server systems.

The RPS enforces essential AES-256 encryption and provides deduplication and replication services. You can have multiple RPS servers where each performs global deduplication. UDP supports plenty of cloud destinations, including AWS, Microsoft Azure and Google Cloud Platform.

From the portal's Protect tab, you add sources and, if they're physical machines, UDP pushes an agent to them. For agentless VM backup, we added our Hyper-V and VMware vSphere hosts and, once imported, we created backup policies for the VMs we wanted to protect.

Policies, or protection plans, are very versatile: you assign nodes, an RPS, the required number of recovery points and a schedule that can be run as often as every 15 minutes. Extra tasks can be added to plans and include replication to a remote RPS and assured recovery, which loads a

ABOVE You can monitor RPS usage and run a range of jobs for protected systems



"Arcserve UDP 10 delivers enterprise-class backup services with an impressive range of data recovery features"

temporary VM on a virtualisation host, confirms that it works correctly and then deletes it.

For malware protection, Arcserve has replaced the Sophos Intercept X software in previous versions with the Windows Defender service on the UDP host. An "Assured Security Scan" can be run on demand from a node's drop-down menu or added as an extra stage in a backup plan.

Our on-demand scan of a VMware VM took a shade over two hours, although host CPU utilisation never strayed above 5%. Arcserve advised us it will be adding performance improvements in the next version.

Other new features include backup and recovery for Nutanix hypervisors, Azure-hosted RPSes, support for Google Cloud Platform as a backup destination and options to replicate an RPS to multiple

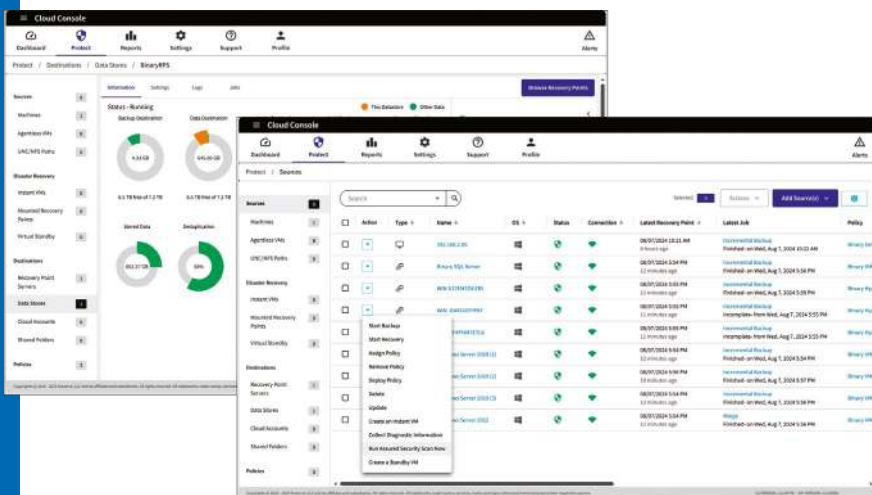
locations in parallel.

Microsoft 365 support has been removed; it wasn't very good anyway and Arcserve prefers you to use its separate SaaS offering.

Recovery features are outstanding. You restore files and folders directly from the cloud portal or recover a VM, virtual drive or entire volume. Virtual standby tasks are clever as they create a VM backup, use a heartbeat service to monitor the primary node and bring the standby VM online if it fails to respond.

Arcserve UDP 10 delivers enterprise-class backup services with an impressive range of data recovery features. It's simple to deploy, value looks good and the choice of on-premises or cloud management adds extra appeal.

LEFT The UDP cloud console provides remote access to the on-premises host



Iperius Backup Full 8.2.4

The web portal is basic, but good application support and top value makes Iperius a fine option for SMBs

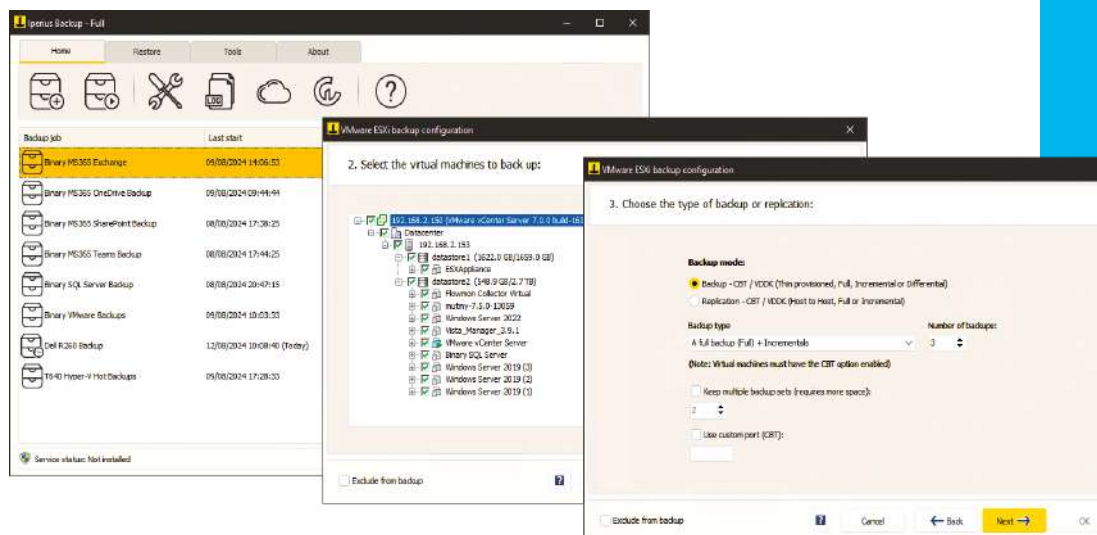
SCORE ★★★★★

PRICE Full perpetual licence, £256 exc VAT from [iperiusbackup.com](https://www.iperiusbackup.com)

SMBS with limited IT budgets will love Iperius Backup as it offers an impressive range of data backup and recovery features at an affordable price. You can start with the free version of the software, which supports all Windows desktop and Server OSes, while the Full version on review delivers a heap of extra features including support for VMware, Hyper-V plus SQL Server and Microsoft 365 (MS365) Exchange, OneDrive, Teams and SharePoint components.

Installing the software on a Windows Server 2022 host took only a minute and you can elect to load it as a service so scheduled backups run without a user being logged in. Bear in mind that Iperius doesn't offer client agents, so to protect other physical Windows workstations and servers you'll need either the free or paid-for installations of the software on each one.

That isn't the case for VMware, Hyper-V and SQL Server, as you can remotely access these hosts from the main Iperius console and protect an unlimited number of virtual machines (VMs) and databases. Value looks even better as the price is for a perpetual licence, the full version allows you to create backup jobs for all MS365 components, and there's no limit on the number of accounts you can add.



Iperius supports an extensive range of backup destinations including local storage, network locations such as NAS appliances, tape drives or FTP/SFTP servers. Cloud support is just as good and extends to Amazon S3, Microsoft Azure, Dropbox, Google Drive and Cloud Storage, OneDrive and Iperius' own cloud storage.

Backup job creation is handled by a wizard that guides you through choosing a source, destination and backup strategy, scheduling it and optionally adding a second backup destination such as off-site storage. Basic ransomware protection is provided as Iperius scans for corrupted and encrypted files and will abort the job if it detects any.

For remote VMware, Hyper-V and SQL Server hosts, you provide their hostname or IP address, assign credentials and browse items for selection. Three Hyper-V protection plans are available, but the agentless option only supports hot full backups of VM virtual disks with block-level and resilient change tracking (RCT) backups requiring an Advanced VM or Full version of the software installed on the hypervisor host.

ABOVE Backing up ain't hard to do with Iperius Backup Full 8.2.4

VMware has no restrictions; we provided our VMware vSphere credentials, remotely viewed all data centre VMs and could choose from basic VM copies or full backups partnered by ongoing incrementals or differentials using change block tracking (CBT). Iperius also supports VM replication to other VMware hosts for disaster recovery.

For MS365 backups, you create separate jobs for Exchange, OneDrive, Teams and SharePoint. Iperius supports modern authentication so we simply added our tenant and used the link provided to enter the unique device code it generated.

The optional Iperius console

"Basic ransomware protection is provided as Iperius scans for corrupted and encrypted files and will abort the job if it detects any"

provides remote monitoring and management of backup jobs and costs around £33 per year for 20 installations. Once the local Iperius app has registered itself and

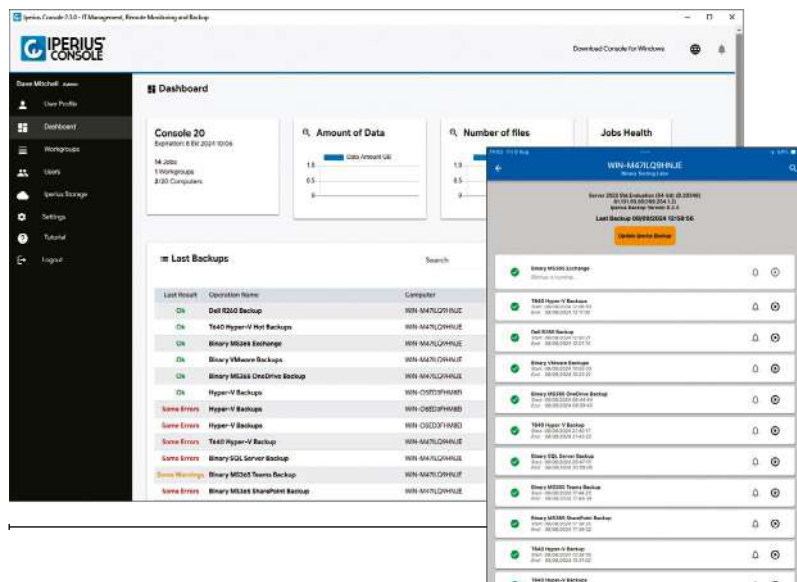
the first backup has run, you can start them from the web portal and modify their schedule.

Iperius makes light work of file and folder restoration as it stores them natively in the backup destination for swift drag-and-drop operations. For our VMware VM backups, we could choose a data centre to restore them back to and browse the contents of Hyper-V hot backups and recover individual files.

The web portal is very minimalist and you may need to factor in extra costs for some features, but Iperius Backup Full is a solid choice for SMBs. It combines plenty of data protection features with great application support and delivers it all at an affordable price.

LEFT Iperius Backup includes excellent protection services for VMware

REQUIREMENTS
Windows 7 • Server 2012 upwards





Nakivo Backup & Replication 10.11.2

The backup host with the most – top platform support, excellent data protection features and a great price

SCORE ★★★★★

PRICE Enterprise, 10 servers, perpetual, £1,118 exc VAT from nakivo.com

SMBs are spoilt for backup software choices, but Nakivo's Backup and Replication (NBR) rises to the top as it supports more host platforms than any other solution. Along with versions for Windows, Linux, VMware, Nutanix and AWS EC2, Nakivo provides packages for Raspberry Pi and all the big NAS vendors, including Qnap and Synology.

Licensing is equally flexible, with a choice of perpetual licences or per-workload subscriptions. Nakivo has an online cost calculator and the price we've shown above is for an Enterprise 10-server perpetual licence with a two-year 24/7 support contract.

NBR 10.11.2 delivers valuable new features including support for MFA-protected Microsoft 365 (MS365) accounts and VMware vSphere 8 Update 2d. Real-time replication of VMware virtual machines (VMs) is currently in beta testing, and businesses using the Proxmox Virtual Environment can secure its VMs free for the rest of this year.

We loaded NBR on a Synology business NAS running DSM 7.2 and found some manual labour is required, as the latest version isn't available in the DSM Package Center app. Following Nakivo's excellent online tutorial, we used PuTTY to SSH to the appliance, download version 10.11.2 and apply it.



NBR comprises three service components, with a Director for browser-based management, Transporters to handle backup, replication and recovery operations, and Repositories for storing backups. A repository on our NAS was automatically created but there are plenty more choices: you can use local or network shares plus standard and immutable cloud storage from Amazon EC2 and S3, Microsoft Azure Blob, Wasabi and Backblaze B2.

Ransomware protection goes even further. During backup job creation you can enable encryption and immutable recovery points that can't be deleted for a set number of days. Malware protection is also present, with NBR employing a separate server hosting Microsoft Windows Defender, ESET NOD32 Antivirus or Sophos Intercept X to scan backups prior to recovery.

We added protected systems to the NBR inventory and our physical Windows servers and Hyper-V host had the Transporter service pushed to them. For our VMware vSphere host, we provided admin credentials and its VMs were presented ready for agentless backup.

Backup jobs cover all protection essentials; you choose systems from your inventory, select a repository,

ABOVE Nakivo uses a malware scanner to check backups prior to restore operations



"Nakivo's Backup & Replication supports an incredible range of hardware platforms and OSes, and is packed with data protection features"

apply a schedule and set the number of daily, weekly, monthly and yearly recovery points you want retained. When creating jobs for VMware vSphere, you can select the host system so any new VMs will be automatically added.

Protecting MS365 accounts requires a special SaaS repository, and we had no problems creating this on our Synology NAS. The MS365 authentication process is a breeze that requires only three steps, and we could then create a single scheduled job to protect all four components.

NBR provides a wealth of recovery features, including files and folders, granular restores for MS365 objects and Flash Boot jobs for creating new VMs directly from the backup repository. To test malware detection, we declared a Windows Server 2022 host as a Windows

Defender scan server and enabled the deep scan option prior to recovering a Hyper-V VM.

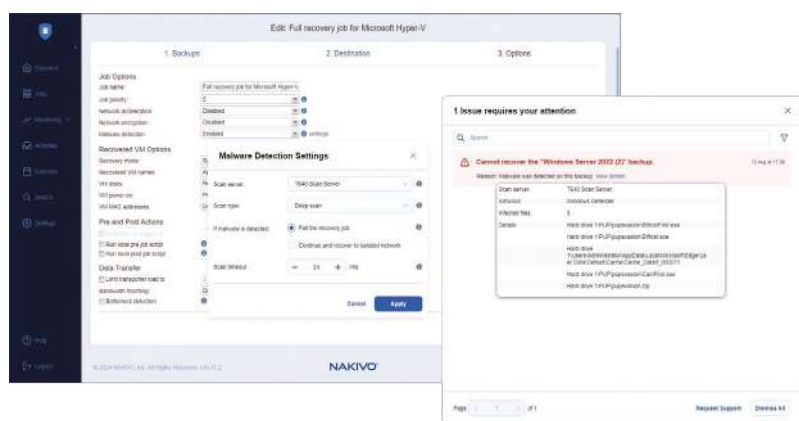
The scan process took over four hours, although to

be fair the VM had 320GB of data comprising over 250,000 files, and CPU utilisation on the scan server never went above 5%. We'd also pre-loaded the test VM with malware and NBR identified it and aborted the recovery job as requested.

Nakivo's Backup & Replication is perfect for SMBs that want the freedom to choose their host system. It supports an incredible range of hardware platforms and OSes, is packed with data protection features and offered in plenty of flexible licensing plans.

REQUIREMENTS

Backup host • Windows 7/Server 2012 upwards, Linux, VMware, Nutanix, AWS EC2, supported NAS appliance, Raspberry Pi



LEFT We had no problems hosting Nakivo on a Synology NAS appliance

Veritas Backup Exec 23

A supremely affordable solution offering complete protection for physical and virtual environments

SCORE ★★★★★

PRICE Simple Core Pack, 5 instances, £498 exc VAT per year from [uk.insight.com](https://www.uk.insight.com)

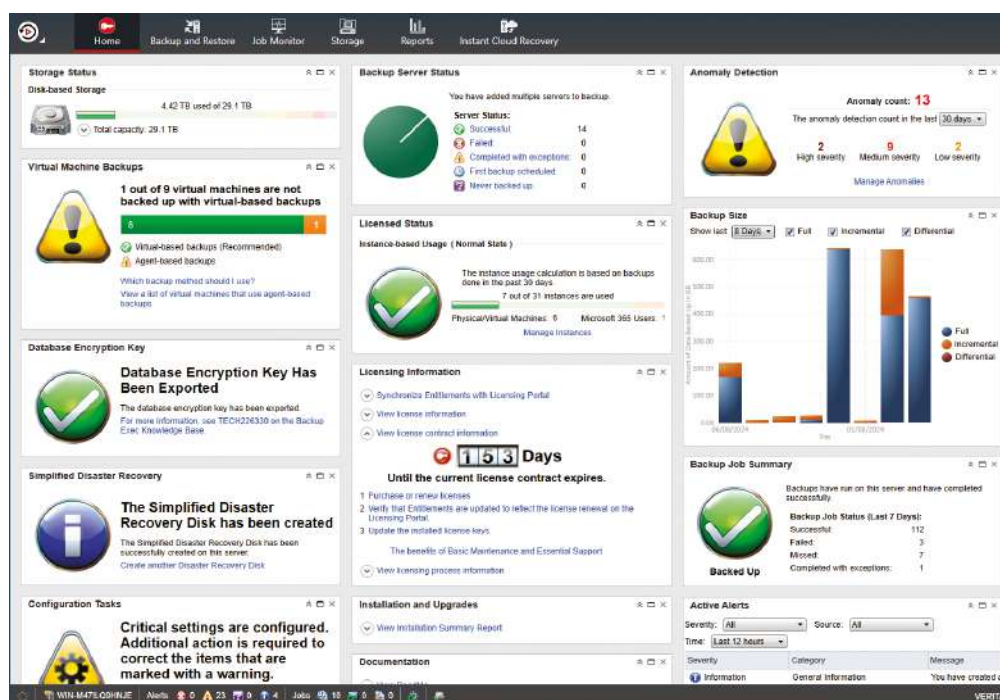
SMBs seeking a complete on-premises data backup and recovery solution will find Veritas Backup Exec has lots of appeal. Licensing is easy to understand, too, with Veritas offering yearly subscriptions for its Simple Core Pack.

This is based on compute instances, which can be a physical system, a virtual machine or ten Microsoft 365 (MS365) users. The starter five-instance licence costs £498 per year and includes a bonus instance for an extra ten MS365 users. More protection can be added via extra Simple Add-On packs, with one instance costing £83 per year.

Backup Exec 23 (BE23) delivers a heap of new features, with a sharp focus on malware protection. You can run malware scans on an ad hoc basis or prior to restoration on VMware and Hyper-V virtual machine (VM) backup sets, with BE23 currently using the Windows Defender service residing on the Windows Server backup host.

The anomaly detection feature now monitors backup jobs and warns of suspicious activity. It compares a range of criteria including backup image sizes, item counts, job times and the amount of data transferred.

Installation is swift. We loaded BE23 on a Dell PowerEdge R260 Windows Server 2022 host in 20



minutes and used its console to deploy agents to our physical servers in the lab. To protect our Hyper-V VMs, we used the preferred method of pushing the agent to the hypervisor host for agentless VM backups.

VMware vSphere protection is even easier: we just had to declare our hosts by providing their IP addresses and credentials. Protecting our MS365 cloud account was a simple matter of adding our tenant using the link provided and entering the device code.

BE23 streamlines backup job creation as you choose your sources, assign a job from the list of predefined ones and set a schedule. You can secure sources to local disks, network shares, a deduplicating store or a wide range of cloud providers. Veritas has added a new forever incremental strategy for VM backups that automatically starts with one full backup followed by partial backups.

ABOVE The malware detection feature can be run on demand prior to recovering a system



“Veritas Backup Exec 23 delivers a heap of new features, with a sharp focus on malware protection”

LEFT The informative dashboard keeps you posted on the anomaly detection service

BE23 adds more performance enhancements as it supports multi-stream backups within a VM and can secure virtual disks in parallel. During backup job creation, you set the minimum and maximum number of streams it should use.

To run on-demand malware scans, you choose a backup set, select this option from the menu and prepare for hammer time, as on default settings it's very CPU-intensive. If this is an issue, you can change the default scan settings to use fewer parallel threads and stop it overriding the Windows Defender CPU-throttling feature.

The anomaly detection kicks in after 30 backups have run and posts alerts in a dedicated console widget. A link provides quick access to the alerts so you can see what triggered them,

and those that are of no concern can be downgraded as false positives.

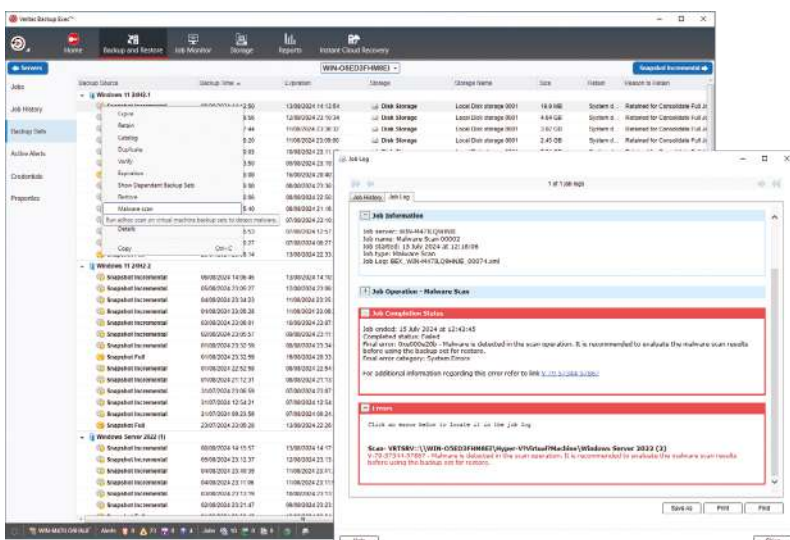
As you'd expect, data recovery features are in abundance. You can view files, folders and volumes on selected sources, pick a

recovery point and decide where to send them. Instant VM Recovery uses an existing backup to create a new VM on the same host, and BE23 now has the ability to restore individual Hyper-V and VMware virtual disks.

Backup Exec 23 is an excellent choice for SMBs as it offers a wealth of data backup and recovery features. It's easy to manage, the new features deliver valuable ransomware protection and the Simple Core Pack subscriptions are great value.

REQUIREMENTS

Backup host • Windows Server 2012 upwards





LincPlus LincStation N1

An innovative all-SSD desktop NAS at a good price, although a 10GbE port would have been welcome

SCORE ★★★★★

PRICE Diskless, £393 exc VAT
from lincplustech.com

Best known for its budget-priced and aesthetically pleasing laptops and tablets, Taiwanese manufacturer LincPlus has now moved into the NAS market. The LincStation N1 aims to stand out as the company claims it's the world's first six-bay all-SSD appliance.

The LinkStation N1 packs a lot into a chassis measuring only 35mm high. Sporting a quad-core 2GHz Intel Celeron N5105 CPU partnered by a generous 16GB of soldered DDR4 RAM, it has four M.2 NVMe SSD slots underneath and two SATA SFF carriers behind the front flip-down panel.

The appliance is ready to go out of the box as it comes with Lime Technology's Unraid software pre-installed with a Basic perpetual licence. Lime Technology recently revised its licensing plans so Basic is now considered a legacy version.

It provides the same features as the new Starter licence, such as support for six storage devices but includes free lifetime updates. LincPlus advised us that once the Basic licences are sold out, newer appliances will



ship with a Starter licence, which provides one year of OS updates with yearly extensions costing around £30.

The appliance has a 2.5GbE multi-gigabit network port, Type C and dual Type A USB 3 ports plus a 3.5mm audio-out socket. The CPU's integrated Intel UHD graphics pipes 4K video to the HDMI 2 port, and there's an Intel AX201 chip inside that delivers Wi-Fi 6 services, although it's of little value as Unraid still has no native Wi-Fi support.

The fan-less chassis employs a clever internal design so it can act as a heatsink. The CPU has thermal paste to help dissipate heat to a chassis-wide metal plate under the lower casing, the SFF carriers are aluminium, and the NVMe slot covers are actually ribbed heatsinks.

Those unfamiliar with Unraid may be faced with a steep learning curve when configuring storage. It doesn't do RAID as we know it, as it aggregates storage devices and protects them with a parity drive, which should have the largest capacity of all installed devices.

We added a 1TB SATA SSD as a parity drive and assigned another to the array for storage. You can add more drives to the array and also nominate NVMe SSDs as cache drives for increased performance.

ABOVE The LincStation N1 packs six all-SSD bays into its tiny chassis

"The Unraid software offers a remarkable range of features, and it all comes at a reasonable price"

The chassis does a good cooling job, but you should still ensure it has adequate airflow around it. The parity sync operation for our SATA SSD took 40 minutes, and during this phase we watched it reach 70°C and trigger a high temperature warning.

When creating NAS shares, you can set them for public access, make them secure so that only authorised users can write to them or make them private for more granular user controls. A unique feature is the ability to specify which disks in the array the share should use.

It's a pity LincPlus's largesse couldn't have stretched to a 10GbE port, as our performance tests

saturated the 2.5GbE port. With a share mapped to a Dell Windows Server host over 2.5GbE, Iometer reported sequential read and write speeds both of 2.2Gbits/sec with random operations

returning the same numbers.

Unraid isn't just about file sharing; it can do a lot more besides. Plenty of apps are available, ranging from backup and media servers to network services and home automation, plus it can host Docker containers and Windows or Linux virtualised OSes.

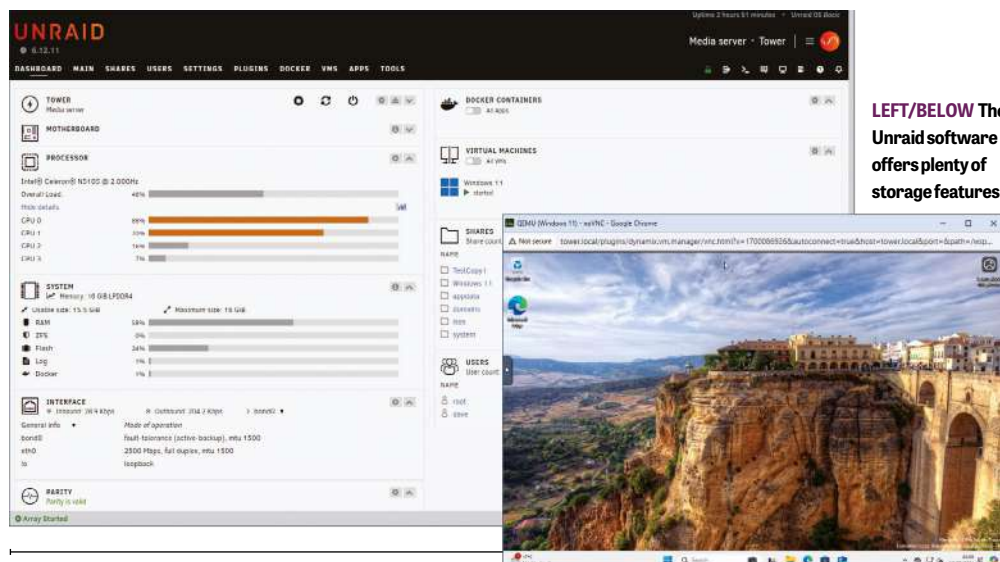
We had no problems creating a Windows 11 24H2 virtual machine (VM) on the appliance. We handed the VM two CPU cores and 8GB of memory, assigned a share storing the Windows ISO file and downloaded the latest VirtIO driver ISO from the Unraid web console.

The Wi-Fi 6 adapter is currently unsupported by Unraid and a 10GbE network port would be preferable but there's no denying the LincStation N1 is a versatile little storage appliance.

The smartly designed chassis handles cooling well, the Unraid software offers a remarkable range of features, and it all comes at a reasonable price. **DAVE MITCHELL**



LEFT The appliance has a 2.5GbE multi-gigabit network port, but sadly no 10GbE option



LEFT/BELOW The Unraid software offers plenty of storage features

SPECIFICATIONS

Desktop chassis • quad-core 2GHz Intel Celeron N5105 processor • 16GB DDR4 RAM • 2x SATA SFF bays • 4x PCI-E Gen3 M.2 2280 NVMe SSD slots • 2.5GbE multi-gigabit • Wi-Fi 6 (not currently supported) • USB-C 3.2 Gen 2 • 2x USB-A 3.2 Gen 1 • HDMI 2 • 3.5mm audio • 60W external PSU • Unraid Basic OS pre-installed • 210 x 150 x 35mm (WDH) • 1.8kg • 1yr hardware warranty

TP-Link SG6654XHP

A top-value Layer 3 switch with a wealth of ports, an incredible power budget and good management features

SCORE ★★★★★

PRICE £2,825 exc VAT
from broadbandbuyer.com

SMBs that thought network switches with full Layer 3 routing and PoE (Power over Ethernet) capabilities were beyond their budget should check out TP-Link's SG6654XHP. It delivers enterprise-class L2/L3 switching and routing services and teams them up with 48 gigabit ports plus six 10GbE SFP+ fibre uplink slots that can also be used to stack up to eight switches.

It provides the full gamut of L3 routing features, including RIP, OSPF, ECMP, VRRP, DHCP Server and DHCP Relay, and adds valuable security measures such as access control lists, port security and 802.1x port authentication. It will appeal to businesses planning on implementing wireless, surveillance and IP phone network services as its 1,440W power budget can supply the full 30W of PoE+ power to every gigabit port.

The switch ships with one hot-plug 900W PSM900-AC module, which provides a total of 764W. To unleash its full potential, you'll need a second optional 900W module, which costs

around £650. If you don't need such a high power budget, TP-Link offers PSM500-AC 500W versions for about £400 with a pair delivering up to 812W.

For management you can opt for standalone mode or move it all to the cloud. For the former, there's a dedicated network port and its well-designed web console has sections for accessing all L2 and L3 features.

Standard L2 features are abundant and include port, MAC and protocol-based VLANs, QoS traffic prioritisation plus static and LACP link aggregation groups. The switch can manage VoIP networks as it identifies traffic from IP phones using their organisationally unique identifier (OUI) and automatically prioritises it by dynamically creating voice VLANs.

That massive power budget makes some of the switch's PoE features redundant, but if you're concerned about exceeding it, you can assign priorities to individual gigabit ports. Apply one of three priorities to each one and, if the drain reaches the power threshold, those with the lowest priorities will be switched off first.

Switch monitoring and diagnostics features are excellent, as the console provides real-time graphs of CPU, memory and network utilisation. Along with support for all versions of

ABOVE The device provides 48 gigabit ports plus six 10GbE SFP+ fibre uplink slots



"The SG6654XHP will appeal to SMBs seeking a powerful Layer 3 switch for core, aggregation or access layer services"

LEFT The 1,440W power budget can supply the full 30W of PoE+ power to every gigabit port

LEFT The switch can be managed locally or remotely from the Omada cloud platform

SNMP, the switch can also run an internal sFlow agent for sending packet sampling data to a collector device.

Cloud management choices are plentiful. You can deploy TP-Link's hardware or free software controller on-site or use its cloud-hosted controller, which has a yearly fee of £165 for 250 devices. We use TP-Link's OC300 dual-port controller appliance in the lab as its £130 price enables lifetime cloud management of up to 500 Omada APs, switches and routers.

All controllers are viewed from the Omada portal home page, and selecting the OC300 transported us to its own console. This presents a ribbon across the top showing all cloud-managed devices, and selecting a site below provides options to create

multiple dashboards with a wide range of widgets.

After we enabled cloud management in the local console, it appeared as pending in our portal so we adopted it and assigned it to a site. It takes only a

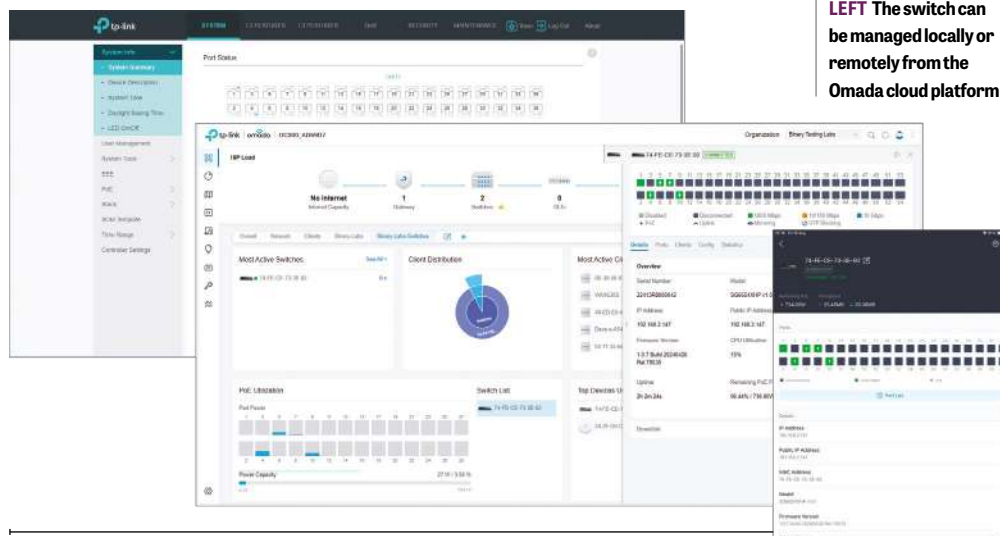
minute, after which the switch disables its local web interface and takes all its settings from the controller.

Selecting the switch from the portal's device page provides a graphic to the right showing which ports are active, their connection speed and those providing power. The majority of Layer 3 services are accessed from the portal's main wired network settings page, where you create multiple VLANs, assign port profiles and configure functions such as OSPF, VRRP rules and policy routing.

TP-Link's SG6654XHP will appeal to SMBs seeking a powerful Layer 3 switch for core, aggregation or access layer services. It delivers a heap of gigabit data and 10GbE uplink ports, stacking support makes it easy to expand, and it offers a world-beating power budget at a very competitive price. **DAVE MITCHELL**

SPECIFICATIONS

1U rack • 48 x Gigabit ports with PoE+ • 6 x 10GbE SFP+ ports • dual-core 1.5GHz Arm processor • max 1,440W power budget • 802.3af/at PoE/PoE+ • 216Gbits/sec backplane capacity • 32K MAC addresses • hot-plug 900W PSU (max 2) • web browser or Omada cloud management • limited lifetime warranty. Options: PSM900-AC PSU, £650 exc VAT





Is it time to upgrade your business Wi-Fi?

Do you need to invest in a faster, more reliable wireless network? **Steve Cassidy** asks the key questions

The convenience of wireless networking can't be denied, but it's almost always slower than an Ethernet connection – especially if, like many businesses, you're still relying on last-generation standards. As high-speed Wi-Fi 6 hardware becomes ubiquitous, and the first Wi-Fi 7 access points start to trickle onto the market, many businesses will be wondering whether it's time for a wireless networking boost.

Naturally, a key question to consider is whether the potential gains of buying new hardware are worth the expense. And if they are, do you need to replace your existing system, or supplement it? As so often happens, once you look more closely into the matter you'll find it breaks down into several smaller questions.

The first thing to talk about is what we mean by "business Wi-Fi". There are plenty of smaller, rural businesses that get by very well with a domestic-grade internet line and whatever boxy little router was bundled with it back in 2013. Such networks can chug along untouched for very long periods, because the demands placed on them are so basic: the router operates only as a gateway to online email, CRM and accounting services, so the users' experience depends purely on the performance of the back-end internet line, and the websites they're accessing in the course of their working day.

This isn't what we'd normally understand as a business network, however. That phrase typically implies that someone is responsible for performance management,

advanced traffic handling and secure authentication. It will also usually work in tandem with a wired infrastructure: there are organisations out there relying entirely on Wi-Fi client connections, but even these are likely running old-fashioned cabling to their access points, gateways, security appliances and printers.

One further defining feature of a business network is the ability to create VLANs – virtual Local Area

Networks, with their own addresses and settings, that are wholly defined in the firmware of the company's routers, switches and firewalls. VLANs are particularly important in Wi-Fi setups where there's

almost no limit to the number and type of clients that might connect, as they let you keep traffic from less trusted parts of a deployment wholly separate from the assumed-safe stuff that's sent and received by properly managed internal devices.

"A key question to consider is whether the potential gains of buying new hardware are worth the expense"

The catch with VLANs is that they can quickly get you into complicated network configurations, both in terms of the physical layout of your network – with base units, repeaters, antennas and so forth – and the virtual topology. So we can add compatibility and security to our considerations: a business Wi-Fi setup will be expected to support a range of devices and standards dating back literal decades, while also coping in a quite different way with the latest vulnerabilities and network-level attacks.

If that doesn't sound like your network then you should perhaps be considering more of a foundational upgrade, to bring your whole workplace up to professional standards. But that's a discussion for another day.

■ Performance anxiety

The most common reason to upgrade a Wi-Fi infrastructure, or any network, is to gain better performance. Compared to even a cheap Ethernet connection, Wi-Fi can be slow. A typical Wi-Fi 5 access point might have a theoretical maximum

RIGHT Upgrading your Wi-Fi won't help if you have a slow internet connection

"A few targeted code optimisations could do more for productivity than any investment in high-end Wi-Fi gear"

BELOW Many firms are still using old routers that don't support the latest Wi-Fi standards

whether you can improve matters with a simple configuration change. The handed-down wisdom is that the first step is to use an otherwise empty wireless channel, in order to avoid interference – but

this isn't really as important as it used to be. In the old days of 802.11b networking, interference could severely impact performance, but newer

standards use very wide frequency bands that mean some overlap is often inevitable. As a result, modern Wi-Fi devices have had to become much better at channel management, and interference has dropped down the list of likely causes for performance issues.

What can often make a difference is MIMO. Short for Multiple Input, Multiple Output, this term refers to an access point's ability to handle multiple connections at once. It may seem incredible that, up until about five years ago, Wi-Fi base units communicated with devices strictly one at a time. Today, if the AP supports 4x4 MIMO, that means it can send and receive from four different clients at once, or it can use four separate data streams to communicate with a single device at quadruple speed, if the client supports it.

That's the final thing to bear in mind: performance is a two-way street. When you think about upgrading your Wi-Fi you might naturally focus on the back end, but you also need client devices that are capable of making the best of the services on offer. Old laptops, device hubs and printers often have limited top speeds, and when they eat up the base station's airtime by using older standards with slower

data rates it results in a worse experience for everyone else as well.

■ Staying secure

Aside from speed, the other good reason for upgrading a network – and a wireless one in particular – is security. Those who have been in the game a few decades will remember

the push to rip out and replace old routers and gateways that relied on the WEP security standard, after it was shown in 2001 to be easily breakable with a simple hack.

Hopefully, very few businesses are sitting on a timebomb like that today, but the WPA standard that replaced WEP has its own weaknesses, and even the enhanced WPA2 system is susceptible to specific attacks – look up the "KRACK" hack, which could allow an eavesdropper to spy on your supposedly protected packets. If you can move your network to the latest WPA3 standard you'll be in a much stronger position, security-wise.

There are plenty of other aspects of security to explore. Delve into the configuration page for your base units and you'll probably find no end of details and settings concerning encryption algorithms, certificate repositories, demilitarised zones and VPN tunnelling protocols. Do you need to master all of these technologies? They can add some worthwhile additional layers of security, but they won't prevent users from naively giving away their connection credentials in a phishing scam, or writing them on a Post-it note that's clearly visible through the window.

No matter how smart your hardware, therefore, I recommend relying minimally on secure access to your Wi-Fi. Big companies don't let users into their systems with a single network passphrase: they want passthrough authentication, in which the Wi-Fi deployment lets users log in with their Active Directory credentials. That's a smart idea whatever size your business may be. If your on-premises Wi-Fi is located outside of your security envelope, an

intruder can do very little harm even if they do get onto the network.

This type of approach has administrative benefits, too. You should



wireless bandwidth of around 1.7Gbits/sec to share between all connected clients – and even when there's only one device connected, it will only see a fraction of that speed, owing to its distance from the transmitter, interference from other devices and networks and so forth.

Before rushing out to replace your Wi-Fi access points with newer, flashier models, however, first investigate whether wireless bandwidth is actually a bottleneck for your workflows. If you're mostly accessing cloud services, you might get more benefit from a faster internet pipe. If you're relying on bespoke, in-house applications, a few targeted code optimisations could do more for productivity than any investment in high-end Wi-Fi gear.

It's also worth exploring whether you really need new hardware, or

RIGHT A new network card can work wonders for an older laptop



already have security policies in place for dealing with employees connecting from home, or from the train, or from a hotel in China – so why not keep that experience consistent when they connect from their desks? It's simpler for users, easier to manage and support, and much less likely to expose you to security loopholes.

■ Mix and match, or strip and flip?

Let's say you've decided the time is right for a Wi-Fi hardware upgrade. The next decision isn't exactly a technical one, but it's nevertheless fundamental to how you proceed: are you going to add new hardware to your existing network, or bin your old routers and APs and replace them with newer, faster, smarter gear?

This is a question many businesses have recently faced with Wi-Fi 6, and it won't be long before it comes round again with Wi-Fi 7, especially for those who decided to skip over the last generational upgrade. Fully replacing an older system is conceptually very clean, but it isn't an approach for the faint-hearted, especially if you need to upgrade your clients at the same time. Aside from the technical work, it can be tricky to get together the necessary budget and manpower for a big-bang project like this, and some disruption to the business is hard to avoid.

It's normally a lot easier and safer to roll out new Wi-Fi services alongside the old ones. This allows you to phase in the new technology gradually; when problems arise, users can drop back onto the legacy network while you work them out. The precise nature of the upgrade is something each business will have to work out for itself, but in all cases I recommend network administrators get familiar with static routes and the ROUTE ADD utility in Windows: this allows you to wholly segregate different wireless networks, each having its own IP numbering and DHCP, pointed to from your default gateway by a static route table entry, as if it were situated in a distant branch office rather than overlapping with your existing transmitters.

■ To mesh, or not to mesh?

Wi-Fi performance is greatly affected by distance, with farther-away clients experiencing a slower connection. So one way to get the best service is to ensure that there's a base station located close to every device that needs to be online.

If you don't want to cover your walls and skirting-boards in cabling, a mesh configuration can be an attractive way to achieve this, with a

gaggle of base stations passing traffic back and forth between themselves, allowing users to access internal resources, and the internet, via whichever mesh unit is nearest to them.

Curiously, while there are dozens of mesh systems available for home use, it's an idea that's been slow to catch on in business environments. One possible reason is that quite a lot of industrial processes use high-voltage electricity supplies, which play havoc with the wireless signal and wreck any attempts at multi-hop networking. I've visited several sites where any type of Wi-Fi would be burnt to a crisp by the ambient energy levels, including a pylon ceramic insulator testing company, an oil pipeline flow meter manufacturer and a racing car factory. Even if you can get a usable connection from your laptop to an access point, you definitely want that AP to connect back to the router via old-fashioned Ethernet.

However, if you're running more of an office-based business, there are a few mesh options to choose between, from established brands such as Cisco and Netgear. The major question becomes how many stations

BELOW It's usually easier to phase in new tech gradually to work alongside your older devices



you need, and where you're going to situate them. Mesh nodes work best when they have a strong connection back to the primary router, or to a neighbouring node. This can

"One way to get the best service is to ensure that there's a base station close to every device that needs to be online"

necessitate a fine balancing act, as you naturally don't want to situate your stations too far from the clients that want to connect – and you may find that the ideal location is unhelpfully located in front of a window or next to a microwave oven spraying out electromagnetic interference. Thankfully, almost all mesh units also support wired backhaul, giving you the option of installing them in places where a regular wireless signal would struggle. ●

What about 5G?

As more and more services move into the cloud, and as mobile coverage gradually gets faster and more reliable, you might be wondering: do we need to provide our own Wi-Fi at all? Can't we use 5G mobile connections for wireless working?

It's not a crazy idea. All the tricky problems of user authentication, signal overlap, multiple session sharing and so forth are handled by the 5G operators, so why duplicate the effort? And of course any issues of working from home versus company-owned infrastructure go away in an instant: your users can connect, authenticate and work in exactly the same way anywhere there's a network signal.

Be warned, though: going all-mobile isn't as simple as you might imagine. If you're using any legacy in-house systems or devices, making them accessible to an internet-only workforce is often more trouble than it's worth. It's a model that's better suited to small startups that can build their processes around 5G, rather than established businesses, where the gateways and databases may well be older than the fork-lift trucks and photocopiers. Even cloud-connected devices often obstinately cling on to real Ethernet, or offer no way to log in and modify their basic LAN settings to make use of a wireless connection.

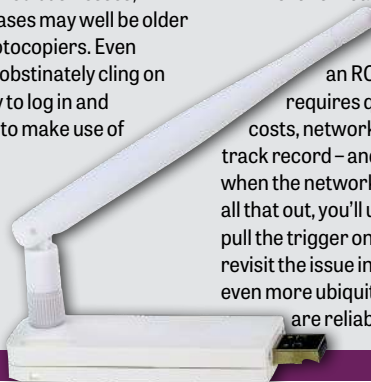
Nor does 5G necessarily relieve you of the requirement to own and manage your own infrastructure. If your business is going to be reliant on the mobile signal, you need

to know it's going to be available and reliable when you need it, which may mean deploying 5G repeaters around a built environment just as you would Wi-Fi access points.

Ideally, if you're considering going down this route, you should be talking to a 5G provider about locating some base stations in and around your property, and getting a proper contract in place establishing a certain level of service and agreed gigabytes of bandwidth. This isn't normally a cap, as with personal mobile contracts, but a guarantee that you'll spend at least a certain amount: go over and you may qualify for discounts, while coming in lower than the agreed amount can occasion penalty charges to make up for the revenue shortfall.

Remember, too, that dealing with contracts ties you into the supplier's business cycle, meaning you may have to wait until a contract is over, or for a particular anniversary date, to make changes – not a great prospect for companies with performance issues or a thirst for the next big thing.

All of this means that relying on 5G for wireless services usually isn't the great hack it might at first appear. Getting an ROI statement together for 5G requires quite a wide regard for business costs, network deployment, security provision and track record – and of course a plan B for those days when the network isn't available. Once you've worked all that out, you'll usually find it makes more sense to pull the trigger on that Wi-Fi upgrade, and maybe revisit the issue in a few years' time when the cloud is even more ubiquitous than it is now, and 6G services are reliable and pervasive.





Load balancing

Want to get the best from your computing resources?
Steve Cassidy finds out how to spread the load

I've heard this phrase before, but what exactly does it mean?

Well, that's the thing. It's perfectly possible for two informed people to have a prolonged technical discussion on this subject, and both come away quite sure a consensus has been achieved – while having completely different ideas of what load balancing is really used for, or where it takes place. But broadly speaking, it means spreading work across a portfolio of computing resources, so you don't end up with one computer getting overloaded while others sit idle.

So is this primarily a server thing?

You could argue that load balancing is everything but a server thing. Servers are the eventual beneficiaries of load balancing, but the activity itself generally takes place upstream from the data centre. For example, if you explore the DNS definition for CNN, you'll find the domain doesn't resolve to a single IP address: each DNS request returns an address different from the previous one, with the effect of spreading traffic across multiple destinations. This is a load balancing function that's not located anywhere near the servers, or even the business that receives the directed traffic.

So load balancing is just about alternating between addresses?

This simple "round robin" approach to load balancing has its advantages, but there are other strategies available, with varying degrees of intelligence and complexity (*see below*). They also have different strengths, depending on what you actually need: what are your requirements for continuous availability, inter-server syncing and acceptable performance? The longer your customer transaction, the more important it becomes to use effective load balancing.

It takes different strokes

Load balancing can be applied at the network level, or it can focus on individual servers and applications. In either case, there are many different strategies to choose from.

Static load balancing methods don't require any direct communication with the server. They include **round robin**, which cycles through a list of server destinations, and **weighted round robin** – which is the same, except that some servers are sent more connections than others. **IP hash** is another static strategy that picks a server based on the originating IP address of the request, so that individual users will usually be connected to the same server.

How do I know my load balancer is doing its job?

Start simply: check your server logs and see whether the load and performance counters all look roughly the same, or whether some resources are getting hammered and others are underused. If you see spikes when everything is peaking at once, that's probably not a fault of the load balancer, but a bottleneck elsewhere; modern resources such as all-SSD servers and software-based enterprise-scale storage with smart deduplication can radically transform your ability to cope with variable demand.

What if my load balancer gets overloaded? Do I need multiple balancers? Where does it end?

It ends in the cloud. If you're regularly seeing major ups and downs in overall demand then that's a sign that you ought to be engaging a cloud host and developing a profile for their orchestrator software. The response to your load problems becomes not spreading demand across a fixed set of in-house servers, but availing yourself of a theoretically infinite suite of virtual servers, which you can instantiate as needed and shut down again when things go quiet.

So is this something I can leave up to my cloud provider?

The thing about the cloud is that it can bring enormous benefits, and also enormous bills. Many businesses' cloud strategies are largely focused on trying to control costs.

Sure, if you leave load balancing up to a cloud provider you may see amazing results: Azure offers a huge range of virtual infrastructure objects devoted to spreading traffic and workloads across virtual resources and physical locations. The catch is that you pay for every last byte that passes through them. It's always worth exploring whether you can get along with a cheap and cheerful model; most SMBs don't need the theoretically infinite resources that the cloud can offer.

Dynamic load balancing takes the server status into account. The **least connection** method polls all available servers and sends traffic to the one with the fewest open connections; **least response time** chooses the server that responds quickest. The most advanced is **resource-based balancing**, which monitors each server's available resources and sends the incoming workload to the destination best able to deal with it.

There are many different ways to implement load balancing. You might invest in a hardware load-balancing appliance, or you could implement load balancing as a software service running on an existing piece of infrastructure. ●

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Real world computing

Expert advice from our panel of professionals

JON HONEYBALL

“If you have any interest in how computing will move forward, then you need to see this in action”

Jon is bowled over by Apple's Vision Pro, experiments with paying for the blue-tick version of “Twitter”, and wonders if AI-assisted photography has gone too far

I am almost one month into ownership of my Apple Vision Pro, and I remain hooked. I use it every day, if only to sit in wonderment at its ability to place things into the space around me where I want them to go. To have a proper Z-order, to marvel at the astonishing quality of the displays.

The only downside is that it's making real life worse. I recently visited the local cinema to watch the new *Alien* film and concluded that the experience would have been better in every way on the Vision Pro. At the cinema, the black level was definitely grey, and the image was borderline not in focus. The sound was overblown and boomy with too much centre channel. And let's talk about the incessant chatter from other attendees, and the hugely noisy crunching of the paper bags in which the popcorn is delivered.

But I wanted to see the film, being a fan of the *Alien* franchise, and so had to put up with the downsides. Without a doubt, I know I'll much prefer the experience when it comes out on Apple TV+.

I'm not alone. I've given impromptu demos of the Vision Pro to friends and colleagues, and they're left speechless by the *Immersion* demonstration film – and being able to do real work in the environment, whether that's through a web browser, a chat window, Excel or whatever is floating in space in front of them.

The latest build of AVP OS2 allows integration with my MacBook Air

laptop. It's easy to bring up the desktop into the Vision Pro workspace, and it leaves the keyboard and trackpad in view if I'm in a fully immersive environment, such as sitting in Yosemite or on the surface of the Moon. So, after a month, the utter captivation and delight is still there. And that's just the basics; don't forget those developers who are exploring the outer edges.

Talking of which, I also have the Apple Developer headband, which adds a hard-wired USB-C port. I haven't had time to test it in tethered mode, but I'm looking forward to trying video editing in the forthcoming version of Blackmagic's DaVinci Resolve.

But not everything is perfect with this first iteration. I was left disappointed by the Zeiss prescription lenses, which suffer from surface reflections, so decided to buy a second set from a site called VR Optician based in Germany. Its lenses are much cheaper than the official product, but claim to be Zeiss glass, and I paid a little extra for the anti-reflective coating.

They worked reasonably well, but not well enough. For example, because these lenses aren't coded,



Jon is the MD of an IT consultancy that specialises in testing and deploying kit
[X @jonhoneyball](#)

“The only downside is that it's making real life worse”

BELOW The Vision Pro causes wonderment and delight in equal measure

you have to tell the Vision Pro that there are lenses in place. Ultimately I decided these were not the upgrade I was looking for, and so have switched back to the official lenses.

I will repeat what I have said before: go take a demo for free at your nearest Apple Store. If you have any interest in how computing will move forward, then you need to see this in action. I will continue to demo it to everyone I can, although I'm obviously only able to support those who have fine long-distance vision. I also need to try the avatar function in Teams, and maybe even see if I can make it work in the live *PC Pro* podcast video stream. I think some regular attendees might find me even more frightening than usual.

Pay-for Twitter and X Pro

As an experiment, I decided to see what benefits I would get from having a blue tick on Twitter (as I mentioned last month, I refuse to call it X). Of course this meant giving money to Mr Musk, which rankles after his current political ranting against both the UK and US governments. I can't decide if he has totally lost the plot or is doing this for simple publicity purposes. Nevertheless, the ongoing flood of adverts and bots on Twitter was becoming annoying, and it's clear that Twitter is removing the means to block advertisers.

So I ponied up the money for Premium+, £19.20 if you pay monthly, and currently have a blue tick. I like the ability to post longer tweets, but that's not a really big deal. I like that I can edit root posts that I make, but frankly that should be there in the base product. The adverts





Jon Honeyball

Opinion on Windows, Apple and everything in between – p108



Lee Grant

Tales from the front line of computer repair – p111



Dr Rois Ni Thuama

Risk analysis from our expert in cyber-governance – p116



Davey Winder

Keeping small businesses safe since 1997 – p118



Steve Cassidy

The wider vision on cloud and infrastructure – p122

finally appear to be gone, although this took some time to trickle down into my feed. And I like the **pro.x.com** remake of the multi-column app that was TweetDeck. It's web only, however, so I can't get the app capabilities on my mobile devices.

There are other features of pay-for Twitter that are of no interest to me: my following and reading rate is sufficiently small that I'm not going to earn any money from the option where you "get a share of the revenue generated from verified accounts' organic impressions of ads displayed in replies to content you post on X". Nor do I have a great need to see detailed analytics.

I also get access to Grok 2, X's AI engine, which does a good job of providing amusing answers. For example, I asked "why did the chicken cross the road", and it replied with:

"Ah, the timeless question! Here's a classic answer for you:

"The chicken crossed the road to get to the other side.

"But since I'm inspired by the likes of *The Hitchhiker's Guide to the Galaxy*, let's have a bit of fun with this:

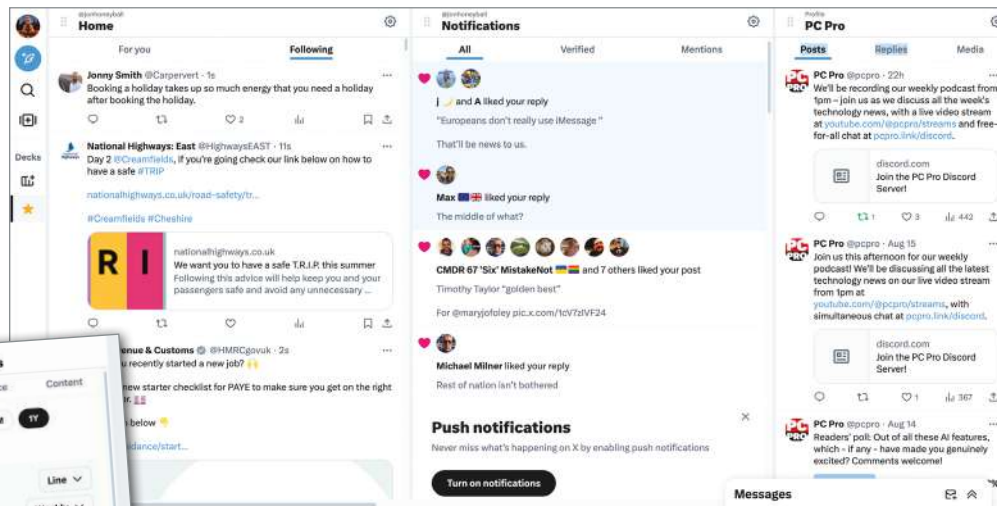
"Philosophical answer: The chicken, embodying the existential journey of all life forms, sought meaning on the other side, perhaps hoping to find the answer to life, the universe, and everything (which, as we know, is 42).

"Scientific answer: The chicken, driven by an innate curiosity or perhaps a genetic predisposition for exploration, ventured across the road to expand its territory or find new resources.

"Conspiracy theory: The chicken was actually part of a larger poultry movement, crossing the road in a symbolic act of rebellion against the agricultural industry's norms.

"Humor: Why did the chicken cross the playground? To get to the other slide!

"Remember, the beauty of this joke lies in its simplicity and the



endless possibilities for interpretation or humor."

Which is fun, but I'm not sure why I would need Grok. I asked it "tell me about *PC Pro* magazine" and it came back with a suitably fluffy answer

but had no mention of Real World Computing columns, so I decided to close the window and get on with some real work.

Is it worth paying so much for this Premium+ account? No, not really. There are other tiers, though. Basic (£3.60 per month) allows for editing of posts and longer posts. Premium, £9.60, also promises "reduced ads".

And here's the real question: will I continue with my subscription? Well, it's a lot of money per month, and although it's less than a round in the pub, I'm far from convinced it's

ABOVE/LEFT Paying for Twitter offers some advantages, but it's not really worth it

"I can't decide if Musk has lost the plot or is doing this for simple publicity purposes"

BELOW Just a few of the 1.94 trillion photos that will be taken this year

worth it. And that's before we consider the utterly toxic nature of Mr Musk and his use of Twitter as a political campaigning platform.

AI cameras overshoot

I've just read that an estimated 1.94 trillion photographs will be taken worldwide in 2024, which is a lot of new imagery. And is clearly testament to the power of the camera in your smartphone.

Recent years has seen significant improvements in the capabilities of the cameras, and much of this is down to what I call "computational photography" – the use of CPU and GPU power to optimise the photography, to ensure you get the best possible result. This can be done by compositing multiple different exposures together to get a strong high dynamic range (HDR). To use machine learning to recognise elements in the picture, and to optimise appropriately – is there a

blue sky? Or what looks like green grass? It also looks for other elements that can provide insight into the composition of the photograph, and help with building this fake, but very usable, image.

Although it's easy to sneer at the term "fake", I'm not using the word in an insulting way. Most people want a good photograph, and are now relying on their smartphone to make the best choices.





Things got really interesting a few years ago with face recognition, and now being able to track eye motion. It's always better to have a wedding photo where everyone is looking at the camera, so taking a video sequence and then having the AI/ML process choose the "best" photo is clearly an improvement over a single shutter release.

But things have gone much further. Now we can use AI/ML technologies to automatically rebuild parts of the image, allowing for people to be removed. Or take out someone in the background or remove an awkwardly placed car. Once you have the AI/ML engine in place, how about adjusting the faces so that everyone is smiling, rather than Uncle Grumpy refusing to play nice in the wedding photo?

Things reached "peak fake" with the latest capabilities on Google phones. Not only can you now take someone out of a photo, you can insert someone else. The idea is that the person taking a group photo is almost always missing from the photo. Get someone else to take a photo of you at the same position, and then the software can stitch you into the composited group shot.

I'm sure this will make a lot of holidaymakers very happy, but you don't need to look far for downsides. We've all seen those "selfie with

someone famous" shots that litter the internet; well, now you don't even need to have met the celebrity. Find a shot with someone else in it, remove them, and insert yourself instead. Welcome to a new wave of fake selfies.

If the celebrities were clever, they would simply put out a set of stock photos of themselves and invite their fans to insert their own picture into the composite. Job done.

Apple CarPlay on motorbike

Last month I mentioned the lovely Beeline satellite navigation unit, now in version 2. It's designed for mounting onto the handlebars of a motorbike or bicycle. It's the perfect balance of information and lack of distraction.

However, for longer-distance touring, especially when going abroad or into places unknown, I really would like more. I've used the BMW/Garmin units in the past, and they're pants. I also tried a recent Garmin unit, but the map database, and especially the listing of speed limits, is already out of date despite claiming to be on the most recent version.

What I really wanted was CarPlay on a screen on my motorbike. And I've found it! It's called Carpuride (carpuride.com) and comes from an unknown (to me) Chinese manufacturer. The build quality is, shall we say, somewhat lightweight, but you can

ABOVE Finally! CarPlay is now on my motorbike thanks to Carpuride

"What I really wanted was CarPlay on a screen on my motorbike. And I've found it!"

BELOW Synology's BC500 camera is hard to get hold of

mount it onto the handlebars via Carpuride's BMW-compatible mounting. I slapped it onto my BMW K1300S and gave it a whirl. It's a big screen, and bright, too. CarPlay pairs up as you would expect, and I leave my phone in a pannier hooked up to a decent USB power bank. After all, GPS still takes a lot of power from a phone, so keeping that running is important.

Best of all, it just works. I get my full normal CarPlay on a screen in front of me. I wish Apple would allow some motorbike customisations, such as having larger buttons for gloved hands, but the mapping improvement of using Waze on a motorbike is a huge leap. And I can use Calimoto, too, which is designed for motorbikes taking interesting trips.

Downsides? Well, the build quality won't impress anyone. And I'm suspicious of a company that won't put its firmware updates onto a public server. You have to contact Carpuride to request the latest version, which seems a little stupid.

But I now have the perfect pairing: Beeline V2 for bumbling around and CarPlay for when I want full-blown mapping. Many modern bikes have satnav functionality built into their digital displays, so the market for units like Garmin is drying up rapidly. The dinosaurs have been replaced.

Axis cameras

Two of my Axis cameras have failed at the lab. Before you panic, there are other cameras covering the same areas, and a huge alarm system. These are 12-year-old cameras and have done sterling work, but it's somewhat strange that two of them died within a week or so of each other. Maybe they read my article on the subject of replacing them five months ago (*see issue 357, p110*) and decided to take action before I did.

I know exactly what I'd like to replace them with: the excellent



Synology BC500 camera (see issue 350, p98). But these are currently out of stock everywhere, so that thought has been scuppered for the time being. I could buy new Axis cameras, but they aren't exactly cheap. There are various devices at the more affordable end of the scale, but they often over-rely on Wi-Fi and flaky built-in DHCP servers, which I know can be a misery on my network. I shall just have to wait for more stock to arrive.

Campaign for Real IoT

I feel it's time to start a campaign. Rather like the Campaign For Real Ale, I want the Campaign for Real IoT.

I am getting heartily tired of companies throwing together cheap IoT devices, in the hope they can entrap you into paying for a monthly cloud subscription. The products are generally of poor quality, because it's a rush job by an ODM (original design and manufacture) firm, usually in China, often simply engineered around something they have collecting dust in the corner.

The outcome is as predictable as it is depressing. The apps are awkward and fail any sort of reasonable usability or design review, and updates are notable by their absence. If you point the monster security test engine that is Nessus at any of these devices, you'll uncover a wealth of unpleasantness, and a Wireshark network analysis can show traffic going to servers in parts of the world you hoped your home camera might not reach.

Then the supplying company either goes bust or stops doing updates. If it goes bust, your subscription to their mandated cloud service stops working. If you're lucky, and it's a security camera, then there might be an ONVIF interface that you can tap into. The manufacturer might have published an API to the device, but I wouldn't bet on that.

Usually, you're left with a smouldering pile of e-waste.

It's about time that IoT devices that run on cloud services are required to put their code into escrow or be forced to open-source at end-of-life, however that might be caused. Otherwise, the pile of wreckage will just continue to grow.

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LEE GRANT

"The machine on my desk was a zombie PC. It was alive, but its brains had been sucked out"

With a nostril packed with raisins, our hero battles a zombie while rescuing hostages from Virgin Media's labyrinthine security system

If your list of hobbies doesn't include reading EU Circular Economy directives, then you probably didn't notice that ESPR came into force on 18 July. ESPR is the not particularly catchy acronym for the EcoDesign for Sustainable Products Regulation, which is merely one cog within the complex mechanism of the EU's 2020 Circular Economy Action Plan. ESPR replaces the existing EcoDesign Directive and widens the product scope while introducing new requirements for durability, repairability and circularity.

Admittedly, my description is insultingly reductive to ESPR. Its framework also contains boundaries on environmental footprints, energy, recycling and a bundle of other stuff that would fill this column many times over.

The positive news is that the unrepairable tech that we bemoan should start to vanish. Not immediately, of course, but by 2027 manufacturers will have to radically evolve their production to place things for sale within the EU. Throw ESPR into the pot with other Right to Repair legislation popping onto statute books around the world and manufacturers could legitimately claim that the regulatory walls are closing in. Globally "we" throw things away that are broken because it's too hard or too expensive to fix them, and this cannot continue.

Take the desktop that arrived in our shop before the summer. The owner, a *PC Pro* subscriber, explained that they'd powered the machine down and, on the next reboot, it refused to do anything exciting except blink a few lights and spin a few fans. Being a *PC Pro* person, the owner had tried a few



Lee Grant and his wife have run a repair shop in West Yorkshire for over 20 years
X @userfriendlypc

"A blank screen and utter silence reassured me I was getting nearer to the problem"

BELOW A new EU directive could help reduce the mountain of e-waste

troubleshooting steps but couldn't coax anything useful out of it. Once wired into our repair bench, I found the same. It twinkled and twirled but nothing else.

When a customer reports that their machine doesn't respond, it's a good bet that the problem will be associated with the power supply. No power equates to no performance, so the fact that this owner was getting lights and fans suggested the machine was alive. I played with graphical outputs, RAM and the other peripherals plugged into the board, but the stubborn thing refused to talk.

The next step was removing the RAM, because if you boot a desktop machine with no memory, it will complain. I slotted a motherboard speaker (tinyurl.com/362speaker) onto the board, fired it up and was deafened by silence. Oddly, a blank screen and utter silence reassured me I was getting nearer to the problem. I put everything back where it belonged, fired up the machine then waited before prodding a few points of the motherboard with my finger. *PC Pro* editor's warning: under no circumstances prod live electronics unless you're a trained professional or, like our columnist, an idiot with commercial liability insurance.

I could feel heat coming from various parts of the board, particularly the CPU, which suggested that things were functional but not functioning. I traced a variety of power lines with a multimeter, and power seemed to flow at various voltages towards different segments of the board. There certainly weren't any zero-voltage "dead zones", so my suspicion was that the machine twitching on my desk was a zombie PC. It was alive, but its brains had been sucked out.





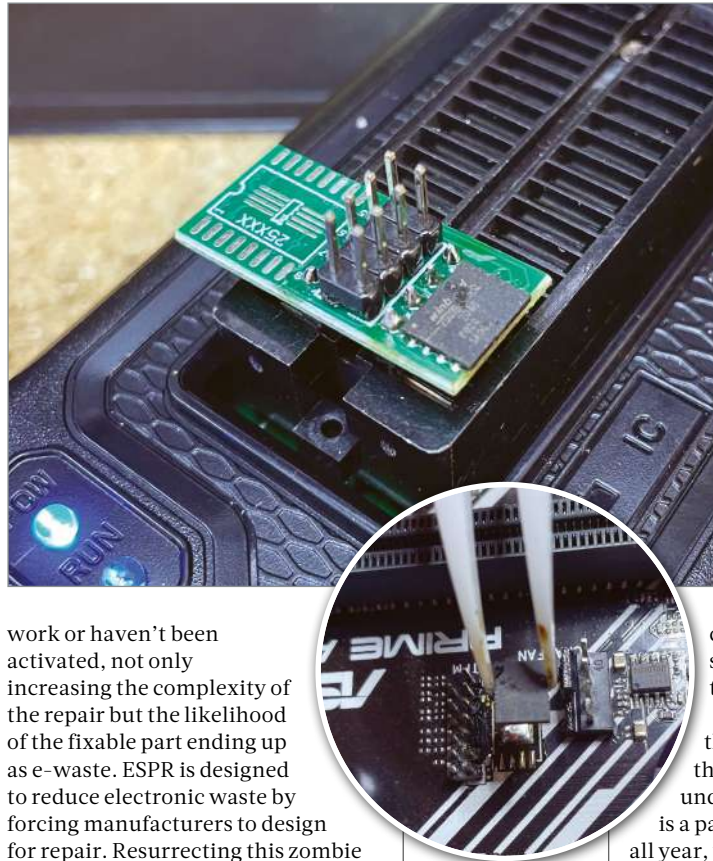
By brains I mean BIOS (or UEFI if you insist), but how do you restore a corrupted BIOS? Luckily this Asus motherboard had a BIOS recovery option. Simply format a USB stick as FAT32, then drop the latest BIOS (from the Asus website) onto the stick, insert into the machine and power on while pressing a given combination of keys. Alternatively, take a raisin, then shove it up your nose. Repeat until your nose is full of raisins and then power on the machine. Generally, the result is the same no matter which method you choose, as BIOS recovery tools are notoriously ineffective. This BIOS needed manually flashing, and this is where ESPR legislation can make this process much easier.

Some readers may remember BIOS chips being socketed and therefore easily removed for re-flashing. Manufacturers ditched those for soldered SOP (Small Outline Packages) ICs, which are around 5 x 5mm and tricky to access. Many modern BIOS chips (including the zombie board) are a SON (Small Outline, No Lead) package, which is a surface-mounted component.

Technically, it's possible to put a probe clamp on a SON, but Asus' designers hadn't left enough clearance from other chips. I needed to remove the board and go to work with a hair dryer. Once the SON had been removed, I had to re-solder it to a daughterboard to attach into a TL866II Plus universal programmer.

We'll fast-forward through the part where I resolve the annoyance of Asus' BIOS file format being incompatible with the universal programmer and rejoin the action when the flashing has completed without errors and I'm frightening horses with a celebratory dance. More work with the hair dryer saw the re-flashed chip back under the microscope for re-attachment. Once everything looked unlikely to short out or burn the shop to the ground, I allowed it to cool, refitted the board and braced myself for a zombie apocalypse. The machine fired up and POSTed. Windows loaded and I could re-unite a *PC Pro* reader with their beloved machine.

A corrupted BIOS isn't a common glitch, but I encounter it more often than I used to. Many of the recovery options built into systems either don't



work or haven't been activated, not only increasing the complexity of the repair but the likelihood of the fixable part ending up as e-waste. ESPR is designed to reduce electronic waste by forcing manufacturers to design for repair. Resurrecting this zombie board should have been much easier.

How not to implement MFA

It's not unusual for people to lose access to their email. Back in November 2023, I received a call from a family telling me that Thunderbird was no longer talking to their ntlworld.com address. For younger readers, NTL was a telecoms company bought by Virgin Media in 2007, and many active ntlworld.com email addresses remain in use today. Behind the scenes, Virgin Media (henceforth VM) has been making a few tweaks, which I asked the company to explain. Its spokesperson replied: "We introduced multi-factor authentication (MFA) to help protect our customers from increasingly sophisticated scams and we're

ABOVE The ESPR will hopefully make re-flashing the BIOS much easier

"I allowed it to cool, refitted the board and braced myself for a zombie apocalypse"

BELOW Virgin Media has been leading customers a merry dance over MFA

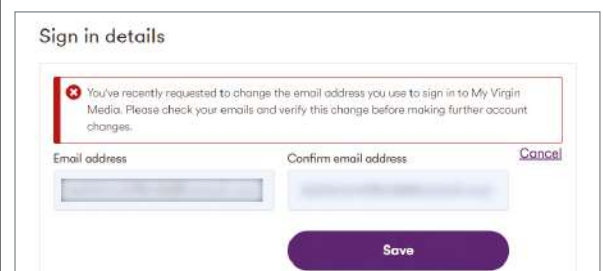
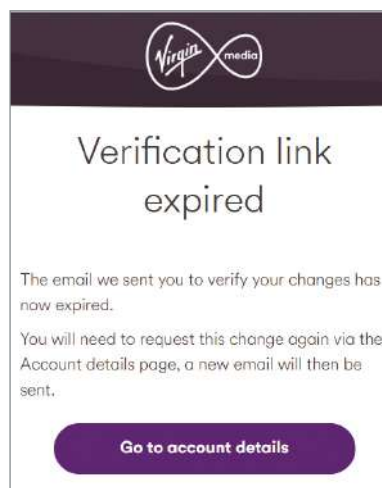
continuing to invest heavily in anti-fraud measures across our business to keep consumers safe."

A tech-savvy reader such as yourself probably has a firm understanding of what MFA is and why it is important that VM implement it to improve security. No-one is arguing that keeping customers safe isn't a good thing to do, but as CrowdStrike discovered back in July, the delivery needs to be seamless and VM's strategy has clearly been signed off by someone that doesn't know their customer base.

It took the family nearly three months to resolve things because they didn't understand the process, and this is a pattern that has repeated itself all year, with many customers having the same problem. Let me walk you through this minefield.

In 100% of the cases I've seen, the customers have an ntlworld.com email address that talks to a mail client via POP3. Email is delivered via their PC or laptop as it has been for the past two decades, and any other method is a waste of brain-space, so stop muttering about webmail, phones and tablets. When the email stops working, they'll have an unsuccessful call with VM support and eventually call me. Their email has stopped because VM has triggered the MFA on their account, so the customer will need to complete the setup process to generate the unique app password that will get their email flowing again.

In its wisdom, VM has decided not to give its users any choice as to which method of MFA is used. It's MFA via email or lump it, and here is the cause of the misunderstanding. For MFA via email to work, customers need to have a second email address as there's no security benefit to sending an MFA code for lee@ntlworld.com to



lee@ntlworld.com. VM's plan is to replace customers' account login address with a non-VM email address, which it can use to ping MFA codes at. As someone who has supported the public in all things techie for two decades, I genuinely feel for VM's support staff. Telling a non-techie customer that they need to create a Gmail address so that it's more secure to log in to Virgin Media sounds like the sort of scam that Gloria Hunniford warns about on *Rip Off Britain*.

Given the inherent complexity of the dance VM wants its customers to perform, it doesn't appear to have put much thought on how to guide customers through it.

To make the magic happen, customers must log in to the VM dashboard, then select Account Settings, then Virgin Media Mail Settings. Remember, at this point, 100% of the cases that I've dealt with didn't know they had a VM dashboard, so they're naturally nervous and overwhelmed at this point. We're redirected to a page called Mailbox App Password, which explains about app passwords, but there isn't any reference to or explanation of MFA at all. The only option is to click "Generate new app password", which takes the user to "Sign in details", where they're supposed to input the new third-party email address for the MFA via email to work, but there's nothing on this page to reassure or guide the wary user.

Once a new email has been inputted, VM verifies the MFA by sending a confirmation link to the new address. All very sensible, but there's a trap. Many of the customers that I've helped have either missed the MFA email or it was delayed. Either way, when the link is eventually discovered and clicked, it has expired.

VM's wording when this event is triggered is completely misleading. "You will need to request the change again via the Account details page, a new email will then be sent." So, back we go to "Sign in details" to re-request a verification link, but there isn't a "resend verification email" option. To make matters worse, when users re-enter their third-party email address (as requested) an error box appears saying: "You've recently requested to change the email address you use to sign in to My Virgin Media. Please check your emails and verify the change before making further account changes."

Users unlucky enough to get to this point – and I know plenty who have – are stuck, but thankfully I

found a fix. At the "Sign in details" page, input a randomly made-up email address. The VM system will send an MFA verification link to this account, but we don't care about that. What's important is that this forces the VM system to forget your previous attempt. Next, at the same "Sign in details" page, change the email back to the real third-party address and VM will re-send the verification link. Wonderhoy!

Keep an eye out for it and click the link when it arrives. The address on the VM account is now changed. The user is dropped back to the VM dashboard where they retrace their steps to generate the app password. Another word of warning: these app passwords only display for ten minutes and there's no mechanism to re-display them. This app password can then be used to update client tools such as Outlook, Mac Mail or Thunderbird.

I contacted Virgin Media to ask it to explain this utter shambles. I asked why it has enforced MFA via email and how it had communicated this to customers, particularly ones

ABOVE Jon's Fairphone was a delight to take apart

"It sounds like the sort of scam that Gloria Hunniford warns about on Rip Off Britain"

BELOW The USB-C port on the Fairphone connects to the board with a simple push-fit



with low-level technical knowledge. VM chose to ignore my questions but said: "We're aware that, due to a technical error, a small proportion of customers were unable to request an additional verification link. We're pleased to say this has now been resolved, and our care team are on hand to help any customers who may require further support."

USB-C needs to change

One hope I have for ESPR concerns USB-C ports. I'm a fan of the EU's adoption of USB-C as a standard format but, because of the complexities of the pins, motherboard makers continue to solder them into place. This was common with laptops over a decade ago, but barrel-jacks eventually migrated to an easily swappable plug attachment. With technology, where one innovates, others will copy, and recently I had the pleasure of digging into a Fairphone, a device built for repair.

The owner of the phone, a Mr J Honeyball of p110, *PC Pro* magazine, sent it over for me to play with, and the ease of access and modularity was impressive. The Fairphone's USB-C port connects to the board with a simple push-fit, making socket replacement a much simpler process and laptop manufacturers need to adopt this fast.

ESPR has built a framework for better design, and it's much easier for legislators to swat away the protestation of OEMs if they can point to devices such as a Fairphone saying, "well, they've managed it". It will be fascinating to see how manufacturers will adapt to ESPR.

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ROIS NITHUAMA

“The days are numbered for scoundrels deploying technobabble to dupe clients”

Don't think of the EU's artificial intelligence act as another piece of boring legislation. On this occasion, everyone's a winner – apart from the charlatans

On 1 August this year, the world's first comprehensive artificial intelligence law came into force in the EU. Well, mostly. The AI Act will be phased in with milestones set at six months, 12 months and about one-and-a-half years, with the whole of the Act fully in force by end of July 2026.

This new law comes not a moment too soon in my opinion, and 2026 can't come fast enough. Am I such a fan of regulation that I welcome every new legislative development? No, I'm not. But I have seen AI being used by scoundrels, charlatans and fraudsters to create a smokescreen, making the proper scrutiny of products and services a near impossible task.

As I never tire of repeating, the fundamental principle of criminology is that crime follows opportunity. Anything that eliminates or reduces the opportunities exploited by scammers to make a quick buck is worth the legislative effort of those tasked with drafting laws to protect society. This is not a victimless crime, as I'll go on to demonstrate. I believe that this Act quite cannily removes an important feature from the Handbook for Total Chancers.

What made me so cynical so young? Settle in, folks. It all started when, a little over ten years ago, I sat and watched the co-founder of a startup pitch an idea for an AI tool. The audience, made up of non-technical people, was assured this tool would



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BELOW The EU's AI law has removed an important feature from the Handbook for Total Chancers

be perfect for in-house recruitment teams and recruitment firms. The tool, the audience was told, could determine with a high degree of certainty which interview candidates would turn out to be dishonest, reducing the amount of time needed to search through candidates, thus reducing costs and improving the outcome for the recruiter, the business and society as a whole. Better results for less, who can argue with that?

If any of the above strikes you as odd, imagine how baffled I was as I sat there. To provide some further context and a partial excuse for the apparent gullibility of many of those who parted with their cash to fund this project, the consequences of the global financial crisis were still being felt and investors were still smarting from the failure of supposedly safe triple A-rated financial products. The scene was set for whizzy new solutions to protect businesses and their investors.

Now, while I accept it's the job of co-founders to dream big, challenge the norm and consider a variety of solutions, the purported features of this tool so closely resembled the talents of Tim Roth's character in the TV show *Lie to Me* that it could have been lifted directly from the script. I was baffled on two fronts. One: had no-one in the room watched the quite fun but wholly implausible show? Two: how did they believe that this tool worked? Well, turns out no-one had to ask.

Sneaky blinkers

That question was dealt with by the co-founder directly and without

prompting. She helpfully explained that the tool would be able to measure micro expressions and non-verbal clues and extrapolate – based on the number of times someone blinked or twitched – whether the candidate was likely to be trustworthy or not.

The trick, you see, was to capture the interview on camera. From this, the tool could review and forensically examine every twitch, blink and nostril flare. Having mapped the physical responses and calculated to what extent they deviate from the startup's library of facial expressions (I can't even get into this), the tool would then conduct further analysis. The results would then be set against the series of questions asked. So, it might have looked something like this: do you like Marmite? Candidate answers yes, I do like Marmite. Nostrils flare. Bingo, you've got a live one here.

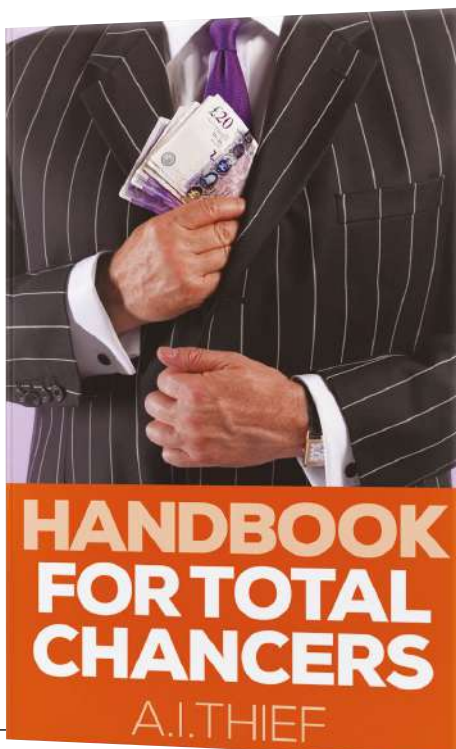
All of this woo-woo was to provide the tool with sufficient data to make a sensible determination and in turn produce a report for the recruiter. Even a stopped clock is right twice a day, so you may have someone who is dishonest. Or you have a candidate that practises yoga or thinks it's a daft question or they've caught a whiff of something troubling or, or, or.

If only I was making this up. I was sceptical, disinterested but with hindsight far too polite. Rather than issuing a guffaw that filled the room, I asked how the tool worked. In direct response to that question the room was told that the tool was devised by a talented mathematician and computer scientist using AI. Interesting titbit of information there, but it went no way to answering the question: how did the tool work?

I'm not suggesting that everyone who flashes AI as part of their solution is a fraudster or charlatan, but undoubtedly investors have been duped by those who deliberately concealed the limitations (and, worse than that, fabricated capabilities) of the technology. When tools deviate wildly from what we know about how the real world operates then we need to take a breath.

Sell the sizzle, not the sausage

The problem with “AI” tools such as this is that nearly every person up and down the chain is a victim of this fraud, whether they know it or not. It's easy to imagine the brainstorming for the marketing of products such as these.



Unconstrained by reality, never mind the actual sausage, the sizzle they have at their disposal to sell is only limited by their imaginations.

And everyone loses. The investors who contribute to the firm that will fail lose their money. The business buying into the “remedy” to reduce the administrative burden of combing through CVs won’t only fail to buy a product that delivers on the promise but will also create liabilities – as Estée Lauder found out when it engaged HireVue (see issue 356, p116). Our third loser: the unfortunate and unsuspecting candidate with dry eyes or hay fever who is removed from the selection process and loses out because the tool imagines that they’re somehow persona non grata.

The other victims of this hype are somewhat more removed. They’re the founders of businesses that utilise AI in ways that *will* work and benefit firms and more broadly our society, but as they don’t engage in the same hyperbolic rhetoric that comes with selling the sizzle, they miss out on crucial funding and are either delayed in getting to market or never make it.

What has the EU AI Act ever done for us?

The EU AI Act runs to over 80,000 words and is helpful in a myriad of ways that align with the broad ambition to address risks to health, safety and fundamental rights, while also protecting democracy, the rule of law and the environment. It’s impossible to make a reasonable fist of highlighting all the benefits, but it is possible to showcase that events like the above will no longer occur.

This is because within the unacceptable risk category lives all the AI that will be banned outright. Specifically, the EU AI Act, Chapter 2 prohibits “the placing on the market, the putting into service for this specific purpose, or the use of AI systems to infer emotions of a natural person in the areas of workplace and education institutions”.

Hey presto, the AI tool that can infer your emotions from blushing, blinking or breathing through your nose is not so much a thing of the

past, but now not so much a thing of the future, either. Which is good news for everyone, but mostly it’s helpful because tools such as these don’t and can’t exist.

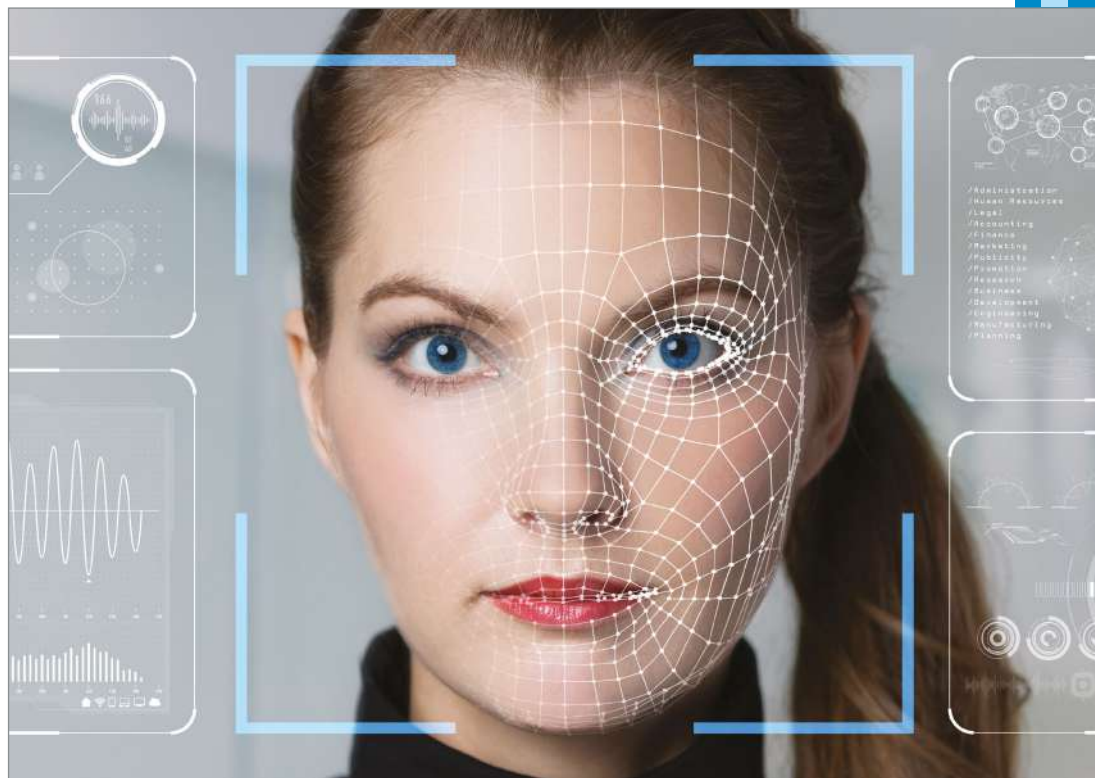
The legislators calculated for useful AI systems, so this prohibition doesn’t extend to AI systems that are intended for medical or safety reasons. And that makes sense. Inferring emotions of a person for medical or safety reasons can be obvious even to untrained observers: pacing up and down on a bridge at midnight looks vastly different to a rational objective viewer than a crooked smile, rapid blinking and a nostril flare.

A tool that could determine that the figure is human, that it’s the same

ABOVE The use of AI systems to infer emotions is prohibited by the Act

“This legislation will likely help useful products and projects to thrive”

BELOW AI is not the best judge of a job candidate’s character



human moving up and down, and that the timing and proximity to the bridge should trigger human intervention is a benefit. It could mean more eyes on the lookout and better outcomes. Importantly, in the bridge instance a false positive harms no-one.

Bright future

Place your bets, folks. I’ll start: I’ll bet that the world will never be in a position where it can figure out someone’s future intentions based on a crooked smile, nostril flare, raised eyebrow, blink rate or eyeroll. Not just because I *think* this is the case; we all *know* this is the case. It also helps to take the view of one of the world’s leading experts on nonverbal communication and body language, Joe Navarro seriously. Whether you rub your nose, fold your arms or blink too often, Navarro’s view is that scientifically and empirically there’s no Pinocchio effect.

The Act provides boundaries for those with unlimited imaginations and a self-serving disregard for those whose lives may be affected by their imagineering. At least in this regard, the days are numbered for scoundrels deploying word salad and technobabble to dupe investors and potential clients.

With regards to genuine creativity, imagination and ingenuity, the criticism that the Act is a constraint looks misconceived. If anything, this legislation will likely have a noise-cancelling effect and help useful products and projects to thrive.

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DAVEY WINDER

“The Redmond giant is lumbering in the right direction with security”

Microsoft is spending \$20 billion on tightening up its security, which is good news – but IT managers and everyday users will need to take action

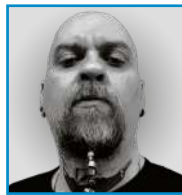
Recently, Microsoft has been on the sharp end of a not particularly deserving security stick, what with the blowback from the CrowdStrike incident that unfairly got laid at Microsoft’s virtual doorstep. Read last month’s RWC for my take on that, I’m not going to repeat myself here. My point being that I think the Redmond giant is lumbering in the right direction with security overall. What’s happening with Azure is a good example of this.

Microsoft’s mandatory MFA move

On 15 October, a new mandatory multi-factor authentication sign-in process will roll out that impacts the Azure portal, Microsoft Entra admin centre and Intune admin centre. An August announcement dropped the 60-day warning for admins, but also confirmed an extended timeframe would be available to customers dealing with more complex environments that create technical barriers for them to overcome.

It’s also worth noting that end users who aren’t signing in to the Azure portal, CLI or PowerShell, but rather accessing apps and services, won’t be hit by the mandatory MFA requirement. Unless, that is, the owners of the services in question mandate it. Which comes with additional implications that mean many won’t consider it. Nobody ever said this security thing was easy, and if they did they were lying.

It’s not all roses for admins, though, with Microsoft itself apparently erecting some of those barriers. One admin told me that the email reminder he received regarding the deadline only identified “the TenantID, the long UID, and not the Tenancy name or name of the



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admin”. Which meant that while he was able to discover he needed to take action, he had absolutely no idea which of the multiple tenancies that action had to be applied to. As he said, “I guess I’ll just have to wait until something breaks”.

Such almost inevitable issues aside – this is Microsoft, after all – it’s hard to argue that moving towards enforcing MFA for admins isn’t a good thing when it comes to protecting identities and data. The Microsoft announcement stated that “we want to reduce the risk of unauthorised access by implementing and enforcing best-in-class standards across all identity and secrets infrastructure, and user and application authentication and authorisation”. I’m only surprised it has taken this long.

I’m not usually a fan of mandatory anything but if, as Microsoft claims, it can block more than 99% of account compromise attacks according to in-house research, I’ll make an exception.

That said, the rollout of this mandatory MFA requirement is less a security sprint and more a snail’s crawl. The measures I’ve mentioned so far are what Microsoft calls phase one of the implementation, with phase two following “in early 2025”. That

BELOW Azure admins should be aware of yet another threat

The screenshot shows a report from Cymulate. The title is "Double Agent: Exploiting Pass-through Authentication Credential Validation in Azure AD". It includes a diagram illustrating the attack flow: an agent on-premises authenticates to Azure AD, which then validates the credentials against a Windows Server AD. The report is dated August 15, 2024, and is authored by Ilian Kalendarov and Elad Beber. A disclaimer at the bottom states that the report is for informational purposes only and should not be used for unauthorized access.

will see the gradual enforcement of 2FA for Azure CLI, Azure PowerShell, Azure mobile app and Infrastructure as Code. Anyone needing additional information is advised to refer to the explanatory post at tinyurl.com/362msmf on the official Microsoft Tech Community blog.

Talking of more technical information, anyone with an interest in Azure Active Directory (I still can’t get used to calling it Microsoft Entra ID, but hey ho) should read a report from Cymulate called “Double Agent: Exploiting Pass-through Authentication Credential Validation in Azure AD”. Grab it from tinyurl.com/362exploiting.

It’s an excellent reminder of why multi-factor authentication is so important. The report highlights a security issue when syncing multiple on-premises domains to a single tenant. “This issue arises when authentication requests are mishandled by pass-through authentication agents (PTA) for different on-prem domains, leading to potential unauthorised access,” the report states. Essentially, the detailed manipulation of the credential validation process turns the PTA into a double agent, hence the report title.

I’m not going to go into all the gory technical details here as, honestly, it would bore most readers to death. The Cymulate researchers do provide a simplified *précis*, though: “When a synced user attempts to sign in to Azure, the password validation request is placed in the Service Bus queue and retrieved by one of the available Pass-Through Authentication agents, regardless of the user’s origin domain. If a PTA agent retrieves the username and password of a user from a different

domain, it will attempt to validate the credentials against its own Windows Server AD. This results in authentication failure because the server does not recognise the specific user.”

The takeaway is that manipulating the credential validation process could lead to security checks being bypassed and a threat actor being able to sign in as any synced user. On the positive side, it’s not the easiest exploit to carry off as it requires a local admin on the server

hosting the PTA agent with global admin user access assigned. Microsoft, for its part, says that “the Microsoft Entra Connect server must be treated as a Tier 0 component as documented in the Active Directory administrative tier model. We recommend hardening the Microsoft Entra Connect server as a Control Plane asset by following the guidance provided in Secure Privileged Access.”

Throwing MFA into the mix for all synced users wouldn’t be a bad thing either, would it? The Microsoft Security Response Center (MSRC) is aware of the issue and, while regarding it as being only of moderate severity, is working on a code fix.

Is your Windows 11 device encrypted? It could be soon

Right on cue to reinforce the “more secure future” messaging from Microsoft comes the news that more Windows 11 users will be enabling BitLocker device encryption. It’s not quite a mandatory move like the Azure MFA thing, but Microsoft is making BitLocker device encryption the default for the Windows 11 24H2 update. It appears that this default will apply to anyone first signing in to a new device and also those using a Microsoft account when going with a clean install rather than an update.

Once again, I see this as a good thing overall as it moves people towards a more secure environment without too much fuss, and that includes users of Windows 11 Home.

It’s made possible because Microsoft is lowering the hardware requirements for such automatic device encryption (at last). What I’m less enthused about is the performance hit it could bring with it. Yes, there’s always going to be a balance between security and usability, but SSD performance has been known to take quite a knock. One test of machines using BitLocker found some saw a 45% degradation in SSD speeds, for example.

Why is Microsoft taking the performance hit? The incredible growth in attacks. In a blog post (tinyurl.com/362weston), David Weston, vice president of enterprise and OS security at Microsoft, put this into numbers: “In 2015, our identity systems were detecting around 115 password attacks per second. Less than a decade later, that

number has surged 3,378% to more than 4,000 password attacks per second.”

Microsoft believes, and it’s hard to argue otherwise, that this means we need “stronger and more comprehensive security approaches than ever before, across all devices and technologies we use in our lives both at home and at work”.

You know where your BitLocker Recovery Key is, right? And have it safely stored somewhere, other than your Windows PC? If not, head to tinyurl.com/362recoverykey. And if you’re an admin this might also be an excellent time to remind your users they should do the same.

Microsoft on the Mac

I started out this month with such good intentions to stay positive about Microsoft when it comes to security, but that’s about to go downhill.

Now, it’s no secret that I moved to the Apple ecosystem as my primary computing environment over the past year. It was inevitable really, what with moving from Android to an iPhone, and swapping my convertible Windows laptop to an iPad Pro over the past few years. When the M3-powered MacBook Pro was announced last year, it was too much of a temptation and I made the leap.

This isn’t to say that I don’t regularly use Android devices (a Samsung Galaxy Z Flip5 is my secondary smartphone) or Windows laptops (a specced out Alienware x17 R2, since you ask). However, my move away from Microsoft to Apple in hardware terms has also meant a switch in the software that I use on a daily basis.

Ulysses is now my default writing tool, for example, and Word has largely been expunged from my memory and that of my computer.



ABOVE Researchers have discovered eight vulnerabilities in MS apps for macOS

“I’m glad I’m my own boss and nobody, apart from HMRC and my partner, can tell me what to do”

BELOW BitLocker device encryption is coming to Windows 11 Home

Thankfully, I mention this as many Mac users are still stuck with the Microsoft Office suite of apps because that’s what’s mandated for work. I’m glad I’m my own boss and nobody, apart from HMRC and my partner, can tell me what to do. Why so? Because researchers at Cisco Talos Intelligence Group have taken a deep dive into multiple vulnerabilities in Microsoft apps for macOS, examining how they pave the way to permissions theft.

Cisco Talos says that it has identified eight vulnerabilities in Microsoft applications for macOS. These impacted Microsoft Outlook (CVE-2024-42220), Teams (CVE-2024-42004, CVE-2024-41145, CVE-2024-41138), PowerPoint (CVE-2024-39804), OneNote (CVE-2024-41159), Excel (CVE-2024-43106) and Word (CVE-2024-41165).

The vulnerabilities enable an attacker to bypass the macOS permission model by “using existing app permissions without prompting the user for any additional verification”. If successful, any privileges already granted to the impacted applications could be accessed. An attacker could, the report said, “send emails from the user account without the user noticing, record audio clips, take pictures or record videos without any user interaction”.

Apple’s macOS permission security model, designed to prevent malicious software and privacy breaches, is based on Discretionary Access Control (DAC) like any other. Beyond this, however, some resources are also secured by a Transparency, Consent and Control (TCC) framework to determine how apps may access sensitive user data. The TCC framework enforces an explicit user consent policy for apps before they are able to access protected resources.





Continued from previous page

“Developers choose these entitlements from a selection provided by Apple, and although only a subset of all possible entitlements is available for general use, the most powerful ones are reserved exclusively for Apple’s own applications and system binaries,” to quote the report. Furthermore, apps distributed via the Apple App Store are sandboxed to prevent code injection by restricting access to resources and data. The researchers found that while many of the Microsoft macOS apps employed a hardened runtime to enhance security, they also had an active `com.apple.security.cs.disable-library-validation` entitlement, which is where the risk is introduced.

The vulnerabilities become highly relevant when an application loads libraries from locations that an attacker could potentially manipulate. “If the application has the `com.apple.security.cs.disable-library-validation` entitlement, it allows an attacker to inject any library and run arbitrary code within the compromised application,” the research revealed. If this were the case, an attacker could then exploit the full set of permissions and entitlements for that application.

Michael Covington, VP of strategy at Jamf, was not impressed. “In the case of the recent findings, Microsoft’s apps were found to disable checks on third-party libraries being loaded,” he said. “This is a noteworthy flaw in apps that naturally require permissions to Apple’s controlled resources, like the camera or microphone, because users are inclined to grant such permissions to collaboration tools like Microsoft Teams or logging tools like OneNote.”

Microsoft has, thankfully, agreed to update these applications. But, and it’s a big but, some apps won’t receive the fix and so will still be vulnerable to attack. Minor apps such as Microsoft Word, Excel, Outlook and PowerPoint, Covington confirmed.

Okay, the actual real-world risk is relatively low, requiring users to grant sensitive permissions, but it does make me wince that Microsoft isn’t fixing something that’s so obviously broken.

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STEVE CASSIDY

“The rationale for buying leading-edge hardware has changed since those early days”

Apple’s shift to Arm-based architecture doesn’t merely have advantages for buyers of new kit, but bargain hunters too – but beware

“I’m old, not obsolete.” Arnold Schwarzenegger fans will recognise this catchphrase from one of the later *Terminator* movies: the battered old robot who won’t give up the fight. Don’t worry, I’m not applying that stereotype to your humble correspondent, however true it might be. I’m thinking more about looking at old equipment and what you’re trying to do with it.

When a manufacturer redesigns their hardware and releases new platform-specific OSes to use that hardware, there’s an enormous ripple effect through the market for their older platforms. The ripples are just beginning now as Microsoft pushes people to its Copilot+ PCs, which are actual and usable Windows deployments based on the Arm architecture. All courtesy of one-time phone manufacturer, Qualcomm.

But those ripples have reached wave sizes in Mac land, and I’ve benefitted considerably from this effect since I returned home from my short stay in hospital. While lying in bed recuperating and listening to the election coverage, I was somewhat amazed to read the news on pricing of Apple desktop hardware. This in the wake of its releases of M series processors for laptops and desktops.

I’ve always coveted top-end heavy metal workstations, and in Apple’s case this has included both its original big, square metal-cased Mac Pro workstations and the curious “trashcan” successor model, released in 2013. Those trashcan machines are now frequently found for under £300. That’s something like a tenth of their retail ticket in 2013, which is enough for me to take immediate action.



Steve is a consultant who specialises in networks, cloud, HR and upsetting the corporate apple cart [@stardotpro](https://twitter.com/stardotpro)

But this isn’t simply due to the price of the hardware: it’s also about the software. The rationale for buying leading-edge hardware has subtly changed since those early days when it was miraculous that computers worked at all; in today’s mature market, buying new hardware will always entail buying new software versions to match the architecture, and software hasn’t been getting any cheaper. If you want bang up-to-date copies of your favourite creative software, you’ll find yourself locked into rolling updates and monthly or annual subscriptions. All of which means that if your favoured software supplier has not been crafty enough to lock out older versions of the software, you can bypass those drip-by-drip fees and pay a one-off cost – or possibly use the licence code you already own.

And there’s another trend to watch here, which is the relative appeal of cloud computing. Older machines with cloud-agnostic software become more attractive each time there’s a big enough global internet outage to reach the national media. I carried on working through the CrowdStrike incident because my main writing

BELOW You can pick up an old Apple workstation for peanuts these days



machine is a peculiar eight-core AMD box from the Windows 7 era. This runs Office 2016, being just barely the last version to be operable without a link back to Office 365 land.

Lots of 365 users were knocked out by CrowdStrike, having accepted the Microsoft proposal that storing all work-in-progress up the wire couldn't possibly have any downsides. While I doubt that many smaller businesses lost appreciable amounts of real-world money in that short but widespread outage, the fact remains that the cloud in general has taken a knock to its reputation in the minds of Joe Public. The reactive response is to turn people back to the older, more independent technologies.

The downside? The internet. Older OSes that run Word and Excel without major incident are almost certain to stagger when obliged to render a modern-day web page. Some people, me included, value a machine that removes distractions and temptations, and being ten years out of date is a neat way of cutting out all kinds of sites.

I might be an outlier with over 30 PCs in the basement, but I know plenty of people who value the air-gap between their personal workhorse and their public data access device, and don't go all peculiar about trailing wires, electro smog or hacker supervillains. For them, the rational protection of their continued productivity includes a heavy dose of future-unproofing – reversing the normal definition of the term, they protect their machine from any future risks by refusing to let it participate in that future.

There are downsides, one of which is that you'll probably need to upgrade some elements to bring it up to scratch. In the case of my trashcan Mac, there are numerous refurb videos and walkthroughs by my friends in the "low-end Mac" community on Facebook, and the to-do list won't be a surprise: think extra memory and a modern NVMe SSD. Other proposed upgrades are less fun. Who really fancies spending a long afternoon taking the whole machine apart just to scrape off the old heatsink paste to apply fresh? It seems like overkill, until you figure out the wasted heat output and therefore the extra electrical consumption. As it stands, my trashcan Mac regularly reports a core CPU temperature in the high 40s, with its permanent rising column of warm air reminiscent of a clothes drier.



A building full of big, old PCs is pretty power hungry. Filling an office floor with gamers' favourite machines can draw two to three times as much power as a comparable, plain and unexpanded motherboard configuration. I actually had a client like this. To be sure, the machines posted nice benchmark scores, but in real-world use they showed hardly any detectable differences in productivity. The offices were noticeably hot and dry, too.

One customer didn't even need the details of machine power consumption or productivity and speed statistics; they had a near mutiny on their hands when a friendly local IT technician popped in for coffee and happened to mention that almost all their machines were at least seven years old. Any faint tone of congratulations for picking such a durable platform way back then, and managing it to minimise downtime and security risks, was blown away by the users' responses: they ought to have newer stuff!

Fortunately I had a couple of retorts pre-assembled against this angry mob, especially considering that the whole Snapdragon story loomed large in their imaginations

ABOVE There are plenty of ways to repurpose an old Mac on the cheap

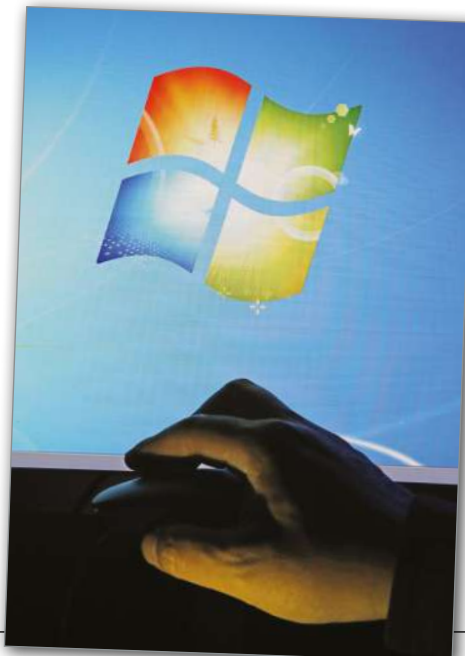
BELOW Many users don't understand what a new processor for Windows entails

without them fully understanding what a new processor for Windows machines actually entailed. Most software will run using the built-in Prism translator, sure, but all those custom apps will need a poor old nerd digging deep into their code locker to make recompiled versions.

I know I've said this before, but this seemed to me an extra-strong case of lockdown time-slip, in which people think other places were still working and producing stuff, with only their neighbourhood being shut down with everyone at home. Their seven-year-old machines were actually more like five years old in lifecycle terms, having been turned off while everyone was at home: the diametric opposite of their server collection, which had been running all the time.

Say no to Windows Mail

Have you taken the offer to upgrade out of Windows Mail? This may be a tad obscure, because I'm the only person I know who has been using Windows Mail to view my cloud-based IMAP mailbox from my Windows 10 workstation. Over the first two quarters of 2024, Microsoft gave us Windows Mail diehards a free chance to upgrade to Outlook. Actually, more of a snare than a chance: being a bit sleepy one morning, I pressed the

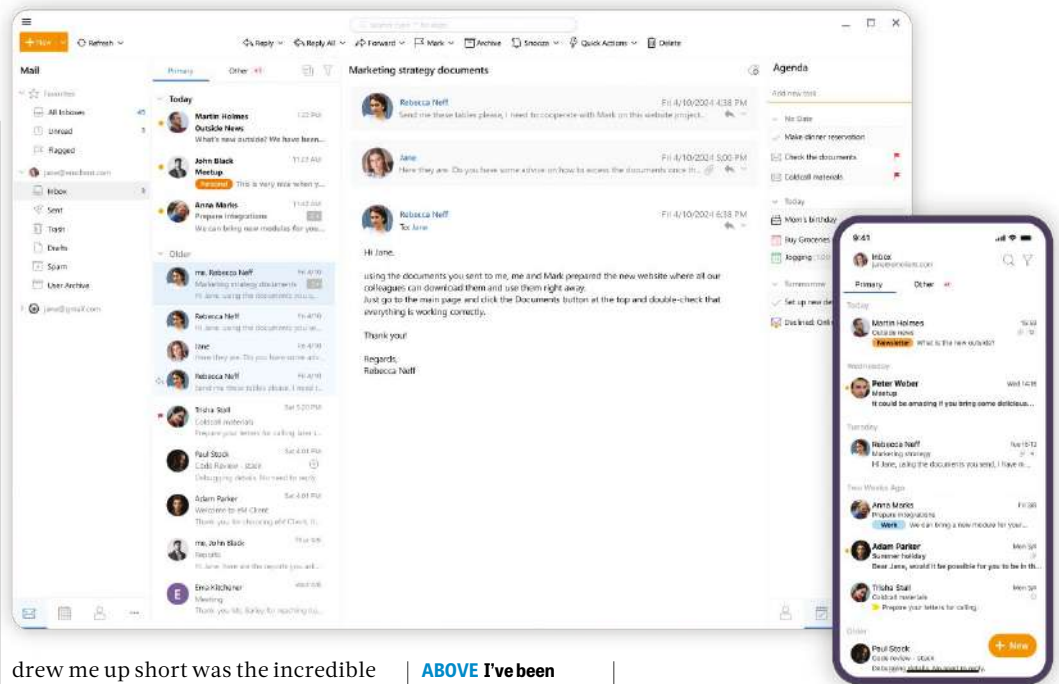


“OK” button on the upgrade prompt, and then tried to ignore all the chuntering about what ensued, apparently automatically copying my settings over from the very old and very over-full Windows Mail setup.

I actually didn’t notice the change for a long time; yes, mails were shown in a pretty window, but there seemed no great leap forward in terms of features. What had changed was the spellchecking code and behaviour. I abuse the spellchecker normally, homing in on the computer’s little red wiggly line that suggests there could be a typo. Such is the strangeness of my brain that very often the spellchecker’s first guess is so off the mark as to be useless, so I must instead remove my splatter of mis-typed keystrokes. I click in the red underlined zone, then use cursor keys to get somewhere so that I can delete and re-type the mess.

This used to work perfectly and still does everywhere that text may be typed in Windows 10, except Outlook. Cursor keys in the misspelt word now move the choice up and down in the spellcheck pop-up list. Entering a space used to, well, enter a space: now it jumps to a message in the folder list, and then deletes that message when I press the spacebar. Gee, thanks for that, Microsoft.

Not only is this fine keystroke detail completely eccentric and different from all the other editors I use, it’s accompanied by strange extra options in the configuration dialogs. Of course, with enough investigation you can figure out how to disable spellchecking, but what



drew me up short was the incredible variety of “corrections” that your email and Windows admin can switch on or off on your behalf. This has transformed the spellchecker into a woke-checker.

You (or an admin) can turn on or off checking for rude words, offensive words and even semantic concepts normally referred to as “isms”. I’m not going to list all those offensive terms here because I want this article to stay findable on the new, squeaky-clean, perfect future internet that some people seem to want. What’s disquieting is the way this great leap forward in staying correct has arrived without fanfare, buried in a feature I had no idea was about to be changed on me. I realise that the younger generation live by various broadly disruptive philosophies, but why does this change in behaviour have to result in me losing emails?

ABOVE I’ve been driven away from Windows Mail into the arms of EMClient

“This great leap forward in staying correct has arrived without fanfare”

Fortunately, I have at least four other email client applications, on Android and macOS and later Windows versions on various laptops, so I only lost messages from the repository on the “upgraded” Windows 10 machine. But this has driven me away from Outlook and into an unexpected safe pair of hands. In the week I started on my spellcheck battles, one of the emails that survived the keystroke confusion was an announcement of a new version of an email app written by a team of developers in the Czech Republic.

I’m talking about EMclient (emclient.com), and I confess that – several years before the pandemic – I had looked at its app and wasn’t moved to switch. But EMClient has not only survived but thrived, it seems. It’s an indictment of the apparent Outlook monopoly that a rather more modest and skilled group of European developers can keep

their product alive through such a testing time. Such is the rate of defections from the assumed standard.

While I might be able to hack my way through a minefield of settings, permissions, policies and precautions and make Outlook great again, right now I’m more inclined to the openness of the EMClient implementation. I’m sure my email correspondents will be able to live with the odd

spelling error, and any broader signs of impending bigotry or incorrect thinking on my part.

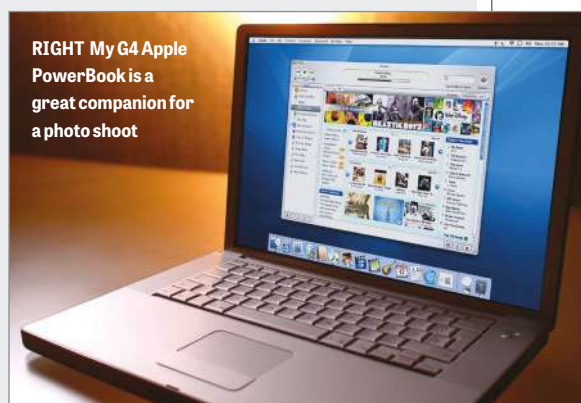
cassidy@well.com

My photogenic PowerBook

I hesitate to describe my default photo-editing machine, because I know it causes irritation, even offence, to a certain kind of leading-edge aficionado. But, without apologies, this is a 17in laptop with a 120GB disk. And it’s a lovely companion for a camera shoot.

What keeps this in my Nikon kitbag is that it’s an Apple PowerBook from the G4 generation. Many years ago, I bought an SSD adapter board that took CompactFlash cards and presented their partitions as if it were a Parallel AT drive, allowing me to get rid of the thoroughly ancient spinning disk without committing to any cloud service, online extra storage or need for a never-ending parade of updates.

Perhaps the most remarkable thing about this device is that it’s not at all wanting when it comes to the job of lightbox duties or photo-editing. The original, retail copy of Photoshop



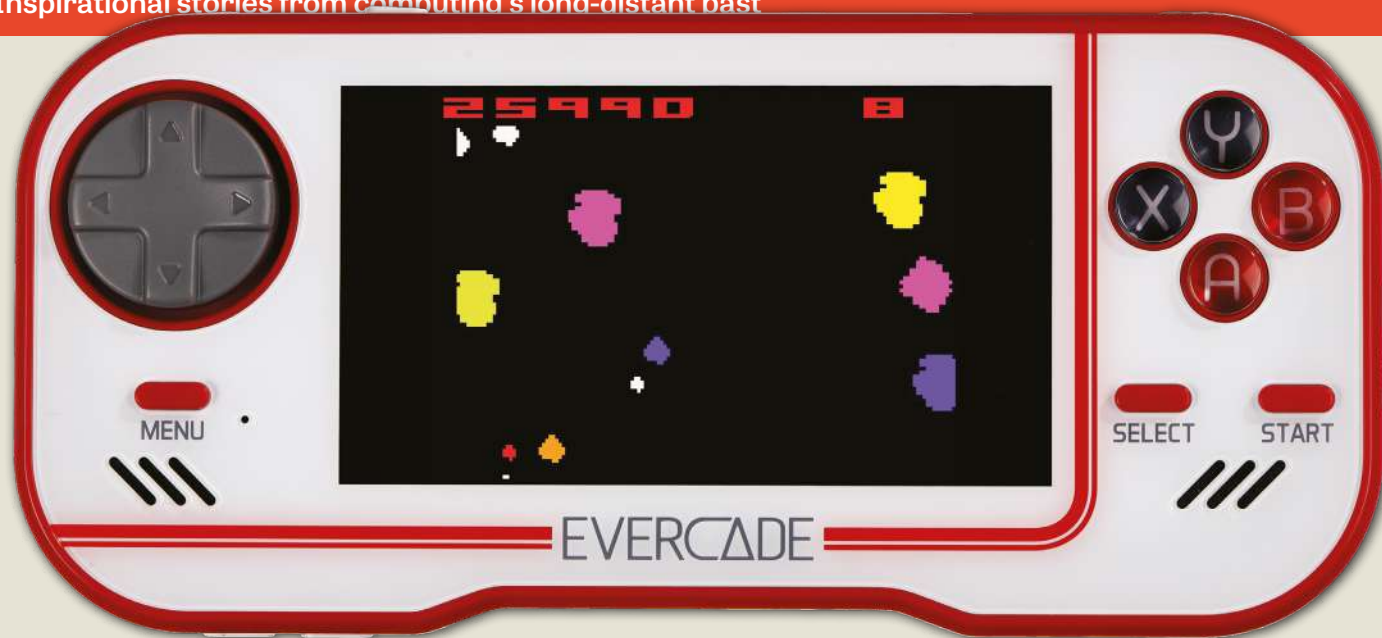
RIGHT My G4 Apple PowerBook is a great companion for a photo shoot

(version 4) does all the fiddling and fudging I want it to, without ever attracting grumbles from visiting nerds or photographers.

RETRO



Inspirational stories from computing's long-distant past



Let's get physical

David Crookes looks at the ongoing success of Evercade's growing range of retro consoles

Gamers are passionate people, and they often like to display their allegiance in the starkest of ways. "We're still amazed by the one person who got a tattoo of the Evercade console, possibly before it was even released," said Andrew Byatt. And, given he is the CEO of Blaze Entertainment, the company behind that machine, it's a story he tells with a smile.

Evercade is a relatively recent success story built upon a hunch that a good number of gamers aren't purely interested in the games they play. They are, as Byatt pointed out to *PC Pro*, just as fascinated by the paraphernalia that has traditionally accompanied games – or at least did before digital distribution became far more commonplace – which is why Evercade predominantly releases retro games on cartridges and places them in nice robust cases together with a printed colour manual.

In the same way that some music lovers feel an emotional attachment not only to the depth and texture of

vinyl but also the liner notes and artwork that adorns the sleeves, many gamers find great value in physical media. They prefer their games on cassette, floppy disk, cartridge, CD, DVD, Blu-ray and even VHS (yes, that was briefly possible) as opposed to digital downloads. And they'll pretty much seize upon any opportunity they can get for something tangible.

To ignore the power of packaging is to cast aside such greats as cover artist Bob Wakelin, the mind behind the splendid drawings that adorned the boxes of *The New Zealand Story*, *Wizkid* and more. And to deny the lure of the physical would ignore nostalgic quirks such as Chris Sievey's *The Biz* – a cassette that contained a rock band management simulation game as well as eight singles and an interview with Sievey's alter ego Frank Sidebottom.

It's why companies such as Strictly Limited and Limited Run Games have sprung up, catering for those who still care about physical media, and why Evercade is proving such a hit. Sure, anyone wanting a retro fix need only

ABOVE The original Evercade handheld launched in 2020

download an emulator to a modern machine and (illegally, it has to be said) grab some ROMs from the internet. "But it doesn't match the experience of having a physical cartridge, opening up the box, smelling a freshly printed manual and the satisfying click of the cart going into your system," Byatt said.

■ Cart attack

The Evercade story began five years ago in 2019 when news of the first Evercade device – a handheld console – first emerged. Capable of being connected via HDMI to a television for 720p big-screen play, it should have been released later that year. Instead, there were delays and the device ended up launching in May 2020 – and the worst period possible.

"Fate engineered us to release during the Covid pandemic and lockdowns, which was a feat in itself," Byatt lamented. But despite the poor timing, the handheld still sold well,

initially appealing to gamers of a certain age who were not only keen to find a fresh way to play old favourites from yesteryear all over again, but to do so with something tangible.

"Evercade is built upon a hunch that a good number of gamers aren't purely interested in the games they play"

The console was based on Linux and included a 4.3in 480 x 272 screen, 256MB of RAM and a 1.2GHz Cortex-A7 SoC. That was more than sufficient for emulating 8-bit and 16-bit games and, as the company told our sister magazine *Retro Gamer* at the time, the emulators were either licensed or developed for the console from scratch. Systems included such giants as the Atari 2600, NES and Mega Drive.

Byatt recalls working non-stop during the first wave of Covid, never quite sure if the idea would take off. "My house was full of stock and we were packaging and shipping units to press and media for review," he said. To convince gamers, the company also had ten cartridges lined up, among them Atari Cartridge Collection 1, which, to ensure value, contained 20 games including *Adventure*, *Missile Command* and *Tempest*.

On the one hand, the decision to release a cart-based machine felt nostalgic – the technology was commonplace from the late 1970s to the mid-1990s. On the other hand, it felt hassle-free.

"The hard work of setting up and making everything work was already done by us," Byatt said, pointing to the steep learning curve and hoop-jumping associated with getting some emulators to work.

Evercade released more cartridges over time, each costing less than £20 and containing between six and 20 titles. "We provided a curated experience and people had a lower sense of decision-paralysis about what to play," said Byatt. "It also meant a lot to fans that everything was legally licensed." Indeed, you can play games on Evercade without fear that you'll ever get a knock on the door from the authorities.

Ever ready

Such advantages continue to this very day. Evercade launched a second-gen handheld called the Evercade EXP in September 2022, following the launch of the home console, Evercade VS, in December 2021. This output at 1080p via HDMI and allowed up to four players to enjoy all of the games released for the handheld. Powered by an Arm Cortex-A53 chip running at 1.5GHz, it included 512MB of DRAM and 4GB of internal storage. It also

had two cartridge slots so gamers wouldn't need to swap them as often.

Rather than rest, however, Evercade is undergoing another refresh with redesigned versions of the EXP and VS. The Evercade VS-R home console has now moved away from its original white styling and comes in charcoal grey. It also supports TATE screen rotation if you have a swivel monitor so you can play vertically as well as horizontally.

The £100 Evercade EXP-R handheld, meanwhile, comes in the same grey colour but adds a textured rear grip. Delayed until November

when a problem (thought to be a faulty component) was found in 20% of the stock, this loses the pre-installed games collection by arcade game publisher Capcom and axes the mini-HDMI port, so you can't connect it to a TV any more. Yet it includes a new, more efficient chipset and comes with a head-turning set of games: *Tomb Raider Collection 1*, covering Lara Croft's first three adventures.

"The EXP-R came about because of the licence expiring on the built-in games and the desire to get the product under the \$100 ceiling," Byatt explained. "We looked at what else could go and we found the HDMI-out wasn't a heavily utilised feature outside of game capture, which many used a VS for anyway. So we have a much more simplified offering that is more affordable."

Indie vibes

Keen to continue expanding the appeal of Evercade, the company has recruited Dominic Wheatley as chairman. If the name sounds familiar, it's because he launched *Tomb Raider*

at E3 in 1996. Wheatley understands the appeal of retro games, which tend to trade on playability rather than graphics, and that people can find modern blockbuster titles to be unfathomably complicated and time-consuming.

Blaze Entertainment has also unveiled the Alpha, a bartop arcade machine that comes in two designs – one with *Street Fighter* visuals and another with *Mega Man* – along with six pre-installed games from Capcom.

Set to arrive in November, it includes dual cartridge slots so users will be able to play any of the Evercade carts. With more than 50 of them now available, that's a lot of choice.

"The introduction of the Alpha gives people another interesting way to play," Byatt said. "We'd always thought about an arcade machine and our deal with Capcom gave us the opportunity to explore the form factor while bringing something new to the table in terms of both games and our cartridge system. It opens us up to a new audience who otherwise wouldn't have taken an interest in us."

This is also great news for indie developers, a good number of whom have been creating entirely new games for the Evercade systems. Although age-old retro titles are the bread-and-butter of the Evercade systems and the catalyst behind the company reaching an impressive sales milestone of a million physical cartridges, Byatt has been keen to bring fresh ideas on board and says indie devs have been hugely enthusiastic.

This has led to a few carts dedicated to modern-retro indie titles, including Big Evil Corporation's puzzle-platformer *Tanglewood* bundled with Bitmap Bureau's multidirectional homebrew shooter *Xeno Crisis*. There have also been three *Indie Heroes Collection* carts, a bunch of NES games created relatively recently by Morphcat Games and *Alwa's Awakening* by Elden Pixels. Such signings fit with Blaze's remit of helping gamers discover new titles, whether they're from the past or being created today. It's always on the lookout for fresh talent.

"We are approached by developers and licence holders and we approach them too," Byatt said. "Take *Full Void* by OutOfTheBit as an example. That came about from going to meet the developer after an initial conversation about something completely



ABOVE Blaze launched the VS-R to make it easier to play Evercade games on your TV

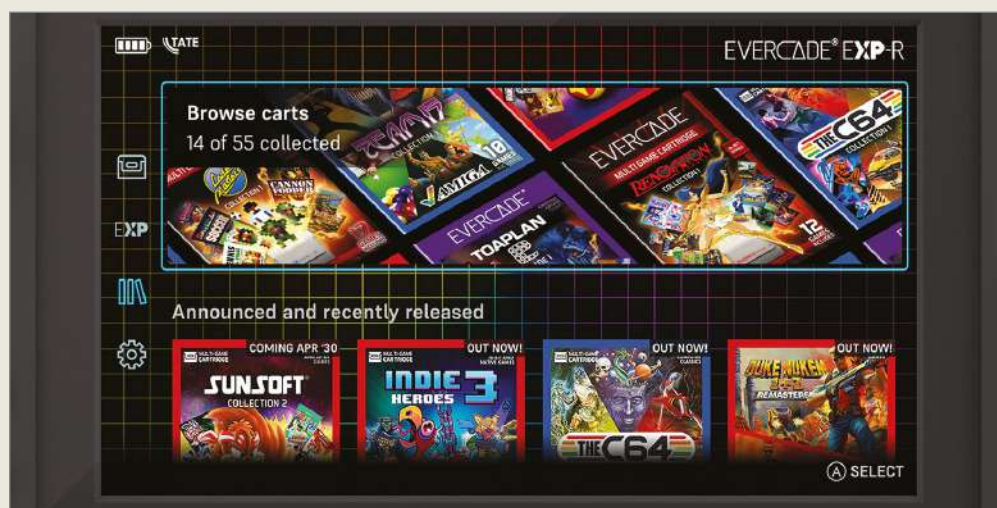


"You can play games on Evercade without fear that you'll ever get a knock on the door from the authorities"

LEFT The Super Pocket handheld comes with built-in games and a cartridge slot

BELOW Each cartridge pack is numbered – catnip for collectors





different. It led us to seeing a yet-to-be-released game and realising how we'd love to have it on our platform."

Full Void became Evercade's first single-game cartridge (all of the others have had at least two titles) and the developer was enthused by the reaction from the device's user base. But then the OutOfTheBit team put in a huge amount of effort, enriching the release with unique extras.

"We poured our hearts into creating the manual for the game and a backstory comic book, along with an artbook filled with early concept art and development insights, included in the Special Edition," said Ali Motisi, director and lead developer at OutOfTheBit.

Motisi now wants to see even more curated indie games appearing on Evercade carts, saying the consoles offer an opportunity for devs to find creativity within limitations. "One potential challenge could have been the size of the game needing to fit the cartridge," said Motisi. "But *Full Void* is only 46MB thanks to our highly efficient custom engine."

Striking a balance

Sales of *Full Void* were helped by Blitz's very early decision to number each release to make all of its cartridges collectible. This approach – inspired by comic books, according to Byatt – means some people will have purchased *Full Void* simply because they want to complete their set. Yet this will help indie developers achieve a better return ("financial rewards are always a consideration and we are extremely happy with the outcome so far", said Motisi). It also means there's extra scope for experimentation and more chances of word-of-mouth advertising.

The collectable nature of Evercade isn't purely beneficial for the bottom line, either. It gets around the issue of cartridge manufacturing being less eco-friendly than digital downloads. "The cartridges are cherished and they are not throwaway products. The plastics and construction of our carts reflect that," said Byatt.

What's more, in an era where retro collecting has become an expensive, often unobtainable, hobby, Evercade fulfils another desire. "It can be a blessing for many collectors otherwise priced out," Byatt said. But to continue being desirable, the main challenge is to ensure that each cart contains games people want to play. "Balance is key," Byatt added. "Quality of the device is very important given the history of licensed retro gaming products, but quality of the games means we have something people will come back to."

To that end, the company has sought to group games as much as possible for greater appeal, and it carefully picks popular themes. Hence collections involving games by Atari, Jaleco, Namco, Data East, the Oliver Twins, Piko Interactive, Team17, Codemasters, the Bitmap Brothers, Gremlin, Intellivision and lots more. These are spread across a host of systems that include the Game Boy, Commodore 64 and Sega Master System.

ABOVE The EXP-R has a 4.3in screen, a 1.5GHz processor, 4GB of memory and Wi-Fi connectivity

"It has sought to group games as much as possible for greater appeal, and it carefully picks popular themes"

BELOW The new EXP-R costs £100 and bundles the first three *Tomb Raider* games



Blaze had something of a head start in this regard as it used to concentrate on making Atari-related products, allowing it to build relationships and confidence. "We've been incredibly lucky to be able to work with Atari, one of the most important and well-known brands in all of gaming," Byatt said. "Their legacy and quality of games helps a product like ours establish itself with great support from licence partners from the off. That helps build a community."

But what of the future? Most sales so far are online, and Blaze wants to change that. "Getting more products on shelves is the plan," Byatt said, with the major target being the North American market. It's no easy feat given retail space for games is dwindling, but Blaze has another trick up its sleeve: inexpensive Super Pocket handheld devices with built-in games and an Evercade cart slot. "It's helped us break that barrier," said Byatt.

Work also continues on identifying retro and indie games that will run on the devices. "There are more arcade games we'd love to see come to Evercade – lots more out there from IP owners across the 80s and 90s that everyone has fond memories of or would be discovering for the first time," Byatt said. "You can pretty much see our current cartridge list and

anything that isn't currently there you can assume we either want or are trying hard to bring it to Evercade."

To that end, Evercade has been widening its scope. Whereas it once concentrated on 8-bit and 16-bit games

before taking in 32-bit, it's gone one step further. "We released the 64-bit version of *Glover* on *Piko Interactive Collection 4* and we're always looking at new systems, but 64-bit is likely our current ceiling at present."

Caution is understandable, though, because Blaze doesn't want to over-complicate matters. "It's important to remember why and how people play these games," said Byatt. "Simplicity is key and games need to be playable on a control pad – we don't want to have complex control schemes or swings and roundabouts to make something work."

With more releases on the way, including a second Bitmap Brothers cart and a *Legacy of Kain* collection,

Blaze seems to be going down the right path. "We wouldn't say there is a set way to go about licensing because people's tastes in games are varied and fluid," Byatt said.

"But we make sure we do enough to ensure we have something that everyone can enjoy." ●

Futures

We explore the trends and technologies that are set to shape the future



The future of work is already here, so what's next?

AI will let you work asynchronous hours – and maybe fewer days, predicts [Nicole Kobie](#). At least that sounds like a nicer future than robots taking our jobs

You work from home, at least a few days a week, keeping up to date with colleagues via Zoom and Slack. Meetings are recorded or transcribed so offline workers can catch up. Line managers engage with employees to avoid quiet quitting, rust out and bare-minimum Mondays. AI helps you code more quickly, manages workflows and

suggests email responses, and there's a trial at your office for VR training.

This isn't the future of work. This is now. But how is it working out for all of us – and what's next?

■ Hybrid life

Some workers prefer office life. Others would rather work from home. Some companies want all hands on deck all

the time, others appreciate the cost savings of downsizing corporate headquarters. The answer is, of course, hybrid working.

According to the Office for National Statistics, 27% of all Brits work both from home and the office, though that covers every type of job. It's difficult to estimate exactly how many UK office workers have hybrid options, but the

Flex Index surveyed 5,000 companies that employ three million people, finding three-quarters offer flexibility to corporate employees, with 44% using a structured hybrid model, with the largest percentage requiring two or three days in the office.

Hybrid work requires staff to be able to work anywhere, and that does cost companies. “All – literally all – capabilities need to be available for both in-person and remote work environments,” said Mike Schumacher, founder and chief strategy officer of Lakeside Software. “And the service and support need to be the same for both workstyles.”

Business support company Town Square Spaces shifted to remote during the pandemic, but that eventually evolved into hybrid working. While that came easily for a company that sets up coworking spaces, there were technical challenges – though many were solved when everyone worked from home during lockdowns.

“That’s not just things like videoconferencing,” said Mandy Weston, cofounder and chief operating officer. “Improvements to items such as security on cloud technology have been important and probably wouldn’t have advanced as quickly if the world hadn’t been forced to adopt remote, ‘access your data anywhere’, working practices.”

■ Hybrid for all

Schumacher believes most tech workers will end up in a hybrid environment as it simply makes the most sense. Staff can work how, when and where suits them, but it maintains personal interactions and collaboration that are key to team building and training.

“The organisation benefits most from in-person work while some individuals enjoy the freedom of work from anywhere,” he said. “There is a happy medium that allows both to achieve their goals.” That is backed by research: Stanford economist Nicholas Bloom studied hybrid working, finding it a “win-win” for productivity, performance and retention.

If you’re not already offering hybrid working, your staff will eventually demand it. Or they’ll go work someplace else. A Skillshub survey of British employees found 43% of respondents would quit if their employer mandated a full return to the office.

■ Virtual first

One way of looking at hybrid working is the idea of “virtual first”: enable staff to work remotely, and give them an office space set up for collaboration. That’s what Dropbox did, turning to its own platforms to build its company as digital first, in office second.



“While it is important to develop the right culture to underpin the Virtual First model, technology is critical to facilitate this level of work,” said Caroline Nangle, HR business partner at Dropbox. “As practically all office-based work is now digital, our own technology provides a streamlined and centralised database to store and organise all digital content.”

British company Cloud closed six of its eight offices, rejigging them into collaboration hubs for teams to gather – they’ve even been used on weekends as a birthday venue and daycare. “Simply using Zoom or Teams in a conventional manner was never going to create a great experience,” said Jeff Dewing, CEO of Cloud.

“I decided to invest in the best camera and microphone technologies, large goin screens resulting in the people that are present mixed with the people that are remote feeling like they are in the same room,” he added. “We also invested in pinpoint cameras, enabling remote personnel [to be] able

ABOVE Video meetings are just one part of the shift towards hybrid working

to see what’s being written on flip charts in the present meeting room.”

Does it work? Dewing reports that productivity is up, employee retention is better and staff are taking fewer sick days.

■ Time no longer matters

If you’re not working in the same place, why work at the same time? This is the idea behind asynchronous working, and it’s perhaps the next office trend.

Nangle says Dropbox is working towards an “async by default” mindset to combine true workplace flexibility with in-person connections. This is partially necessary for Dropbox because the vast majority of its staff work with colleagues in another time zone, but it can also be helpful to smaller businesses offering flexible work times to staff to fit around school drop-offs and the like.

“We set up core collaboration hours and hold these for real-time connection, including one-to-ones,

brainstorming sessions and key decision-making forums,” she said. “These overlap between time zones and encourage employees to design their own schedules when it comes to dedicated focus time, while still enabling collaboration without hindering individual effectiveness.”

There are plenty of tech tools to help shift to asynchronous working. Videoconferencing software such as Zoom and Teams can

“Staff can work how, when and where suits them, but it maintains personal interactions and collaboration”

BELOW Office spaces are still important for collaboration between workers



record calls, transcribe every word using AI, and even summarise key notes, making it easier to catch up on missed meetings. Collaboration tools such as Slack make it easy to indicate whether you're available and to share working times, and keep messages in one place so discussions can happen when you're away from your desk without missing out.

If that all sounds like a lot of messages to work through, you're right. Andy McCaul, managing director of The Bigger Boat, notes that sometimes older tech is the answer. "For example, a colleague might rely on messaging, when a call would be quicker and more accurate," he said.

Nangle says Dropbox found that its "virtual first" model led to more messages, meetings and notifications. "As a result, some employees are having a hard time finding what they need because of the overwhelming number of notifications from the tools required to get work done," she said, citing Dropbox research that revealed that the average worker spends 122 hours per year recovering focus after sifting through their inbox or attending a meeting.

To address that, Dropbox offers guidance on how to communicate asynchronously, so employees all stick to the same method. And, Nangle says, AI can help by making it easier to search through all tabs and apps to find what they need.

■ AI in the office

Ah, AI: a problem to workers facing job losses, but also the solution to workplace challenges. And while other cutting-edge technologies are also likely to make an impact – be it virtual reality for training, immersive metaverses for meeting up in digital environments or smart sensors for watching employee health – everyone we spoke to failed to mention those innovations in favour of AI. It's just on everyone's minds.

"Every job in every company will be impacted by AI," predicted Lakeside's Schumacher. "What job today doesn't use a computer, a spreadsheet or email? Similarly, every position will leverage AI. Some positions won't exist – they will be completely automated. But in the shorter term, you might be replaced in your job by somebody that is better at using AI than you are. At one time, knowledge of Excel was novel; you need to learn to use AI now."

So, what should you use it for? "In the short term, using AI to augment the current business approaches will yield benefits," said Schumacher. "But the huge benefits will derive to those that reinvent business processes in light of an entirely new approach."



Yes, but how, exactly? As we cover in our main feature on p26, much depends on your business and sector. The easy way to get started with AI is to test out the tools that are increasingly embedded in the software you already use, such as Microsoft Copilot or Zoom AI Companion. There may be costs associated, though some tools are offered for no extra charge.

The other way to consider AI is to figure out what problems you have in your business – your bottlenecks, the dull routine tasks staff have to do repeatedly, what annoys your customers. Then see if AI can be applied to address those challenges, perhaps sending a handful of keen staff on AI training so they can consider the issue on behalf of the company. AI guided workflows and

ABOVE It can be hard to keep track of all your messaging tools

chatbots might not solve your problem, of course, but it's worth a shot.

As Schumacher notes, using AI to tweak business practices this way really is the low-hanging fruit. Once you've gotten to grips with AI, it's time to consider bigger ideas, he says.

"All the research shows that productivity either increases or stays the same, showing how much time we waste at work"

■ Four-day weeks

Here's a big idea: work four days rather than five, on the same pay. Effectively all the research shows that productivity either stays the same or increases, showing how much time we waste at

work when we could be living our lives. The idea is beginning to grab attention, with massive trials showing positive results across different sectors.

Gareth Hoyle, founder of Marketing Signals, shifted his team to a four-day week in 2022 with no loss of pay. "I already measured my teams based on output not attendance, meaning it's incumbent on team members to produce results, rather than to demonstrate how many hours they spent working on something," he said.

The firm covers the full week by having two shifts: one working Monday to Thursday, the other working Tuesday to Friday. The shifts flip every week, so the team has alternating two-day and four-day weekends. "While regular group calls on a Tuesday, Wednesday or Thursday [when both teams are working] help, I've found that investing in task/project management software is the best way to promote a seamless workflow," Hoyle added.

Productivity is of course a valid goal for any company, but it's reasonable to expect all this extra tech could allow us to work less, too – sharing the benefits with companies and workers. That largely happened with the shift to hybrid working – companies could cut real estate spend, employees can take their children to school – so perhaps the AI-fuelled workplace revolution could have upsides for both, too. ●

Digital access

The shift to flexible working powered by digital technologies has helped businesses recruit from a wider range of people, be it those unable to commute daily because of health reasons or caring responsibilities, or people from different geographies. That's the good news. The downside is that digital technologies aren't always inclusive.

Beyond setting up secure access to corporate networks and upgrading the Zoom account, companies need to remember to avoid digital exclusion. Jonathan Hassell, CEO at digital accessibility consultancy Hassell Inclusion, notes that as businesses become more reliant on digital technology, it makes it harder for those with additional challenges – perhaps because of reduced vision or fine-motor difficulties.

"Often this 'exclusion' starts in the recruitment process, which means that employers are effectively falling at the first hurdle, disabling people from applying for positions, or performing to their best in online interviews," he noted. "Beyond that, there are at least ten other points in the employee journey where accessibility needs to be considered in digital tools and comms, including onboarding, training and meetings – all of which also contribute to employee retention."

He added: "In a technology-first world, a proactive approach to digital accessibility is not a 'nice to have', it is a business essential."

PC PRO

Next month

ON SALE

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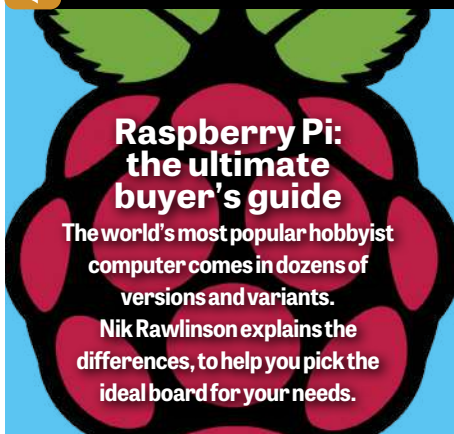
Features



PC Pro Technology Excellence Awards 2024

Find out which brands are the most (and least) trustworthy in the UK's most comprehensive survey of tech reliability and customer support.

Features



Raspberry Pi: the ultimate buyer's guide

The world's most popular hobbyist computer comes in dozens of versions and variants.

Nik Rawlinson explains the differences, to help you pick the ideal board for your needs.

Features



Run your home network like a pro

Could business-grade gear make your home Wi-Fi faster, more secure and more manageable? Darien Graham-Smith finds out.

Labs



Mini PCs

We review a range of mini PCs next month, from the tiny NUC-style units that are ideal for light duties to gaming systems that squeeze in the latest cards.

Retro

The mystery of the Acorn Communicator

David Crookes digs into the truth behind this 16-bit computer that promised so much but never made it onto our shelves.



The Network



Business endpoint protection

Criminals continue to target businesses, and endpoint protection is a vital layer of defence. Dave Mitchell explains what to look for and puts four products to the test.

Futures

Building a new Turing test

With the Turing test now out of date, researchers are working on "Humanity's Last Exam", a test to determine when expert level AI has arrived. Find out what underpins these tests and whether they can ever really work.



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As Jon Honeyball welcomes the arrival of his grand-niece, he wonders what digital future awaits her

As autumn rolls in, and the weather gets colder and wetter, opportunities to go out for a long ride on one of my motorbikes get fewer. Not because I'm a sunny-day-only rider, but because the hassle of getting toggled up for a short ride gets more annoying. No longer can I wear armoured jeans all day and slip on a biker leather jacket; I must encase myself in Rukka weatherproof clothing.

As a consequence, the proverbial "I just popped out to get some milk and appear to have done 100 miles" moment becomes less spontaneous. This leads to less pondering, less thinking time: alone on the bike, on a mostly empty A road, you can clarify thoughts while still concentrating hard on the surroundings.

The 30th anniversary of this august organ recently spurred one such moment. We have travelled far in three decades together, and the industry has changed immensely. Although I was at the initial bleeding edge of the internet revolution, paying BT around £9K per year in the 1990s for Kilostream leased lines that gave me a 512Kbits/sec connection, it's the shock of technology's ubiquity and availability that makes me gasp.

Back then, "the computer" was a thing on your desk, or hauled around in a heavy laptop case. Today, it's everywhere: on my wrist, in my pocket, in my TV. Connectivity then was slow and limited. Today it's available in every location around the world, at all times and in boundless quantities. I was in Berlin for IFA last week, and an eSIM gave me unlimited data for the days I required, for the cost of a few pints of beer.

Born in the mid-1960s, I have been privileged to see this happen, and to record it here in these pages. But what of tomorrow? My eldest nephew Matthew and his wife Lisa have just

welcomed their first child Hannah into the world. Nearly 30 years ago, when Matthew was born, he grew up only a few miles away from me and I saw him regularly. Today, Hannah and her parents live in Norway, yet I get daily videos, photos and updates. In a few years I'll be able to FaceTime with her and help with her homework. With Vision Pro, I'll be able to be in the room with her, too.

All of which is to say that technology has allowed for a huge increase in geographical reach. We are entering an era of true geo-translocation, where you can place yourself anywhere, and see what others are currently seeing.

So we can live anywhere, but I wonder if we're approaching a tipping point when it comes to travel. Will it still be worth getting on a plane for an 11-hour flight when you can enjoy a fully immersive "being there" experience from your sofa? It won't be quite the same – you won't be able to wander around at will, although much of that is simply getting to the bits you want to see anyway. Your tan won't get topped up in the garden when sitting in your house in Surrey in December, and you won't feel the sand between your toes. But will that matter enough to justify the pain and cost of travel?

I don't know the answer, but my worry is that the increased pace of technology and connectivity will ultimately result in us leading more singular, static lives. With the pressures of global warming and the time and eco-cost of moving around – not to mention the near-instant spread of viruses, as my post-IFA man-flu attests – I can see a future where a Google list of virtual places to visit replaces what we now might call "travel experiences".

Some futurists predict that we will have the time to enjoy all of this, because of the reduction of work time caused by robotics and other AI-driven capabilities. But today, to quote an oft-repeated meme, it seems that the AI is doing the art and the music, and I am doing the work.

What sort of world will Hannah have when she is 30? Extrapolating from the past 30 years is almost impossible, because of the rate of change. Will we have fully immersive holodecks, food replicators and endless social and personal time? Or will we have dropped into a dystopian *Blade Runner* future where every

“My worry is that the increased pace of technology and connectivity will ultimately result in us leading more singular, static lives”

thought is used to mine data? And don't think I'm being ridiculous: Ford recently filed a patent application (tinyurl.com/362fordpatent) that would allow it to listen to every conversation you have in the car and use this to drive targeted advertising to you. What sort of awfulness will we have in our electric robotaxi future, where the time taken to get us to our destination is used to drill those personalised adverts into us?

The temptation to switch off and live on a hillside is strong. Give me a wind turbine, a clean stream of water and a sufficient food supply and maybe the noise of the world could be kept at bay. Oh, and a Starlink connection. Just to say hi to Hannah.

■ Jon Honeyball has been a contributing editor to *PC Pro* since issue one in 1994, and fully intends to be around in 2054 to update this column. Email jon@jonhoneyball.com.



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DESKTOP MONITORS

SIMPLIFY YOUR WORKSPACE WITH THE INTEGRATED USB-C DOCK

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